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NATIONAL DAM SAFETY PROGRAM. LITTLE PINE CREEK DAM (NDS PA-351)--ETC(U)
1978 DACW31-78-C-0044
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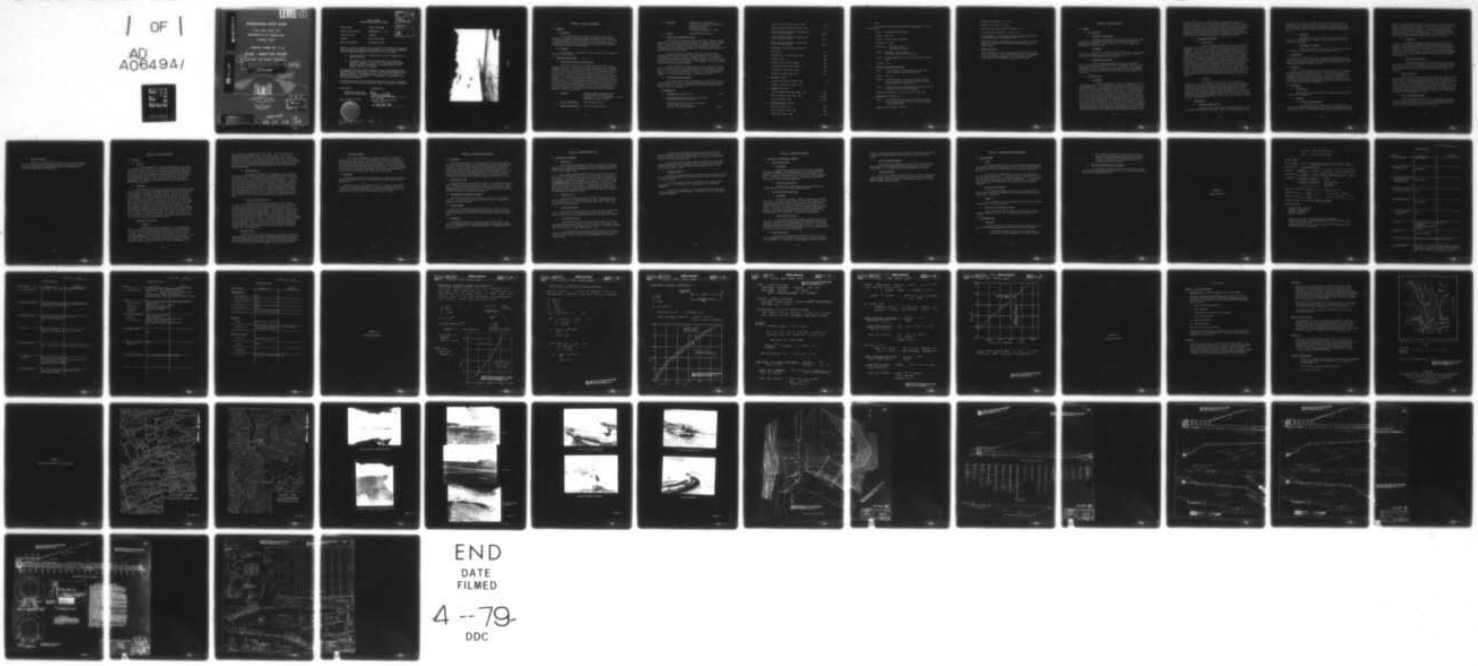

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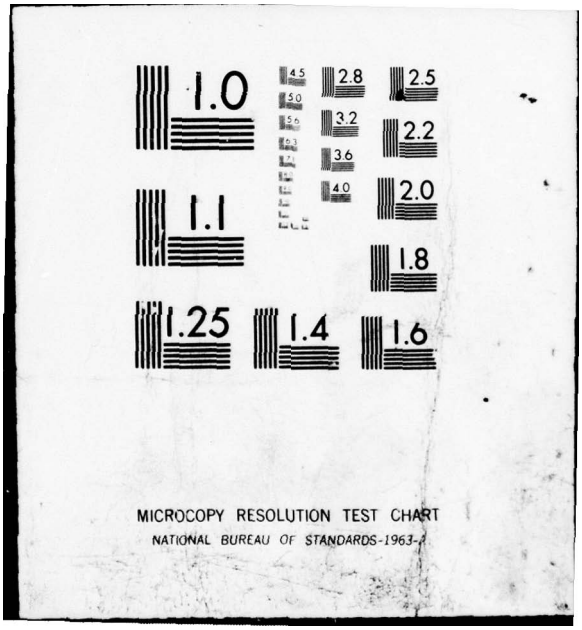
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LEVEL II (1)

SUSQUEHANNA RIVER BASIN

LITTLE PINE CREEK DAM

COMMONWEALTH OF PENNSYLVANIA

LYCOMING COUNTY

INVENTORY NUMBER NDS PA-351

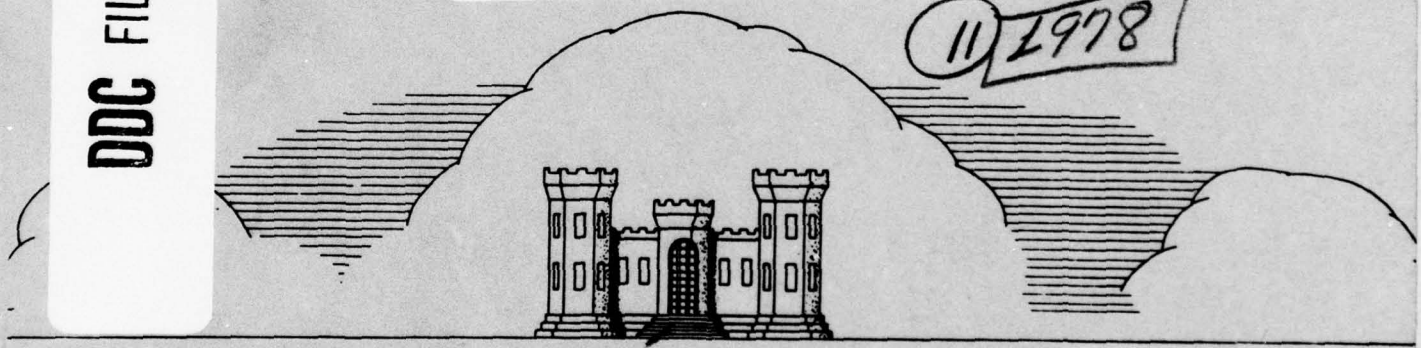
PHASE I INSPECTION REPORT

(6) NATIONAL DAM SAFETY PROGRAM.
Little Pine Creek Dam (NDS PA-351).
Susquehanna River Basin, Lycoming County,
Commonwealth of Pennsylvania. Phase I
Inspection Report.

(12) 57p.

(15) DACW31-78-C-0044

(11) 1978



Prepared For
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland
by
BERGER ASSOCIATES, INC.
CONSULTING ENGINEERS
HARRISBURG, PA.

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	LITTLE PINE CREEK
State & State Number:	PENNSYLVANIA - 41-91
County Located:	LYCOMING
Stream:	Little Pine Creek
Date of Inspection:	September 8, 1978

Based on a visual inspection, past performance and available engineering data, the dam and its appurtenances appear to be in excellent condition. The following recommendation is made for action by the owner.

1. The installation of a trash boom to prevent clogging of the intake structure.

2. The seepage at the toe of the dam shall be monitored and recorded. Changes in conditions during higher pool levels shall be noted to determine if an in-depth study of this seepage condition is required.

In accordance with the Corps of Engineers' evaluation guidelines, the spillway capacity is inadequate to pass the PMF (Probable Maximum Flood) peak inflow without overtopping the dam. The project is capable of passing 74 percent of the PMF and is considered to be inadequate, but not seriously inadequate.

A formal surveillance and downstream warning system should be developed by the owner to be used during periods of high or prolonged precipitation.

SUBMITTED BY:

BERGER ASSOCIATES, INC.
HARRISBURG, PENNSYLVANIA

DATE: October 26, 1978

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
HENDRIK JONGSMA
ENGINEER
No. 5957E

APPROVED BY:

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer

DATE 26 Nov 78

OVERVIEW

ABSTRACT

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

A. Authority

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspections of dams throughout the United States. The Phase I Inspection and Report are limited to a review of available data, a visual inspection of the dam site and basic calculations to determine the hydraulic adequacy of the spillway.

B. Purpose

The purpose is to determine if the dam constitutes a hazard to human life and property.

1.2 DESCRIPTION OF PROJECT

ABSTRACT

A. Description of Dam and Appurtenances

Little Pine Creek Dam is an earth embankment with a crest length of 1123 feet. The top of the dam is 113 feet above the original streambed elevation. A 300 foot long uncontrolled ogee type spillway is located in the left abutment and has a weir crest elevation of 15 feet below the top of the dam, which is at elevation 795.0. The dam was constructed as a flood control project and is also used for recreational purposes. To maintain as closely as possible a fixed permanent pool elevation, a 15 foot diameter concrete conduit was constructed under the embankment with a 9.5 foot diameter vertical drop inlet structure. The rim of the orifice, at elevation 710, is surrounded by concrete pillars to prevent debris from entering the orifice. These pillars support a concrete slab with a valve stand for a 5-foot by 5-foot sluice gate to be used for drawdown. For general plan and typical dam sections see Appendix D, Plates VII and VIII.

B.	Location:	Cummings Township, Lycoming County U.S. Quadrangle, Waterville, Pa. Latitude 41° - 21.3', Longitude 77° - 21.6' (Appendix D, Plates I and II)
C.	Size Classification:	Large (Height 113 feet)
D.	Hazard classification:	High (see Section 3.1.E)

E. Ownership: Commonwealth of Pennsylvania
Department of Environmental Resources
Bureau of Operations
3rd & Reily Streets
Harrisburg, Pennsylvania 17120

F. Purpose: Flood Control & Recreation

G. Design and Construction History

Little Pine Creek Dam was designed by Gannett, Fleming, Corddry and Carpenter, Harrisburg, Pennsylvania, for the Commonwealth of Pennsylvania. A permit for construction was issued on December 8, 1948, and construction started February 25, 1949. The general contractor was Lycoming Construction Company, Williamsport, Pennsylvania and construction was completed in November, 1950.

Severe rainstorms in November 1950 and March 1951 caused considerable damage to the inside of the intake tower and to the outlet stilling basin. Gannett, Fleming, Corddry & Carpenter, the original consultant, investigated the damage and model studies of the orifice and conduit were made at Lehigh University. This damage was also investigated by Justin and Courtney, Philadelphia.

Several proposals for repair were made and in 1953 a 8.5 foot diameter steel conduit was installed inside the 15 foot diameter concrete pipe. This steel pipe is supported on saddles and a transition from the orifice to the steel pipe was poured in concrete. This steel pipe was damaged in 1973 and necessary repairs were completed in 1977.

H. Normal Operating Procedures

Recreational pool level is maintained at elevation 710, top of the drop inlet. All inflow is discharged through this inlet and conduit, until a pool level of 780 is reached, at which level the 300 foot long spillway starts to discharge.

1.3 PERTINENT DATA

A. Drainage Area (square miles)	165.4
B. Discharge at Dam Site (cubic feet per second) See Appendix B for calculations	
Maximum known flood at dam site calculated from recorded pool elevation. June 23, 1972 (Elevation 784.7)	14,810

	Outlet works at low pool (Elev. 690)	154
	Outlet works at normal pool (Elev. 710)	427
	Spillway channel capacity at maximum pool Elev. 795 (top of dam)	67,620
	Outlet conduit capacity at maximum pool Elev. 795 (top of dam)	3,130
	Total discharge capacity at maximum pool Elev. 795 (top of dam)	70,750
C.	Elevation (feet above mean sea level)	
	Top of dam	795
	Maximum pool of record (June, 1972)	784.7
	Spillway crest	780
	Upstream invert outlet conduit	682
	Downstream invert outlet conduit	678.5
	Streambed at centerline of dam	682
	Maximum tailwater (estimated)	700
D.	Reservoir (miles)	
	Length of maximum pool (Elev. 795)	3.8
	Length of normal pool (Elev. 710)	1.2
E.	Storage (acre-feet)	
	Normal (conservation) pool (Elev. 710)	1,100
	Top of spillway crest (Elev. 780)	24,800
	Top of dam (Elev. 795)	35,500
F.	Reservoir Surface (acres)	
	Top of dam (Elev. 795)	793
	Top of spillway (Elev. 780)	634
	Normal pool (Elev. 710)	93.7

G. Dam

For general plan and typical sections, see Appendix D, Plates VII and VIII.

Type: Rolled earth and rockfill.

Length: 1123 feet.

Height: 113 feet above streambed.

Top Width: 25 feet.

Side Slopes: Upstream 3.0H to 1V
Downstream 2.5H to 1V

Zoning: Upstream - select material.
Downstream - Rock toe and earthfill.

Cutoff: Upstream excavated to top rock and concrete cutoff wall.

Grouting: None.

H. Division and Regulating Conduit

Type: 15 feet diameter reinforced concrete pipe with 8.5 feet diameter steel penstock inside.

Length: 618 feet.

Closure: 60 inch by 60 inch sluice gate (invert elevation 682) for drawdown. No closure on outlet conduit if pool rises above elevation 710.

Access: Intake structure on upstream side of dam at Elev.722. Accessible by stairs and footbridge.

Regulating Facilities: 60 inch by 60 inch sluice gate.

I. Spillway (See Appendix D)

Type: Uncontrolled concrete weir of ogee cross section. Also a vertical type drop inlet with steel penstock at intake structure.

Length of ogee section: 300 feet.

Diameter of drop inlet: 9.5 feet.

Diameter of penstock: 8.5 feet.

Crest elevation ogee section: 780 feet, M.S.L.

Crest elevation drop inlet: 710 feet M.S.L.

Upstream Channel: Rectangular, unlined channel with concrete apron extending 40 feet upstream of weir.

Downstream channel: Rectangular, concrete channel of varying slope. It is 356 feet long and has a concrete bucket at the downstream end.

J. Regulating Outlets

Water is admitted to intake structure through a 60-inch by 60-inch sluice gate at invert elevation 682. Water is discharged from intake structure through a 15-foot diameter concrete conduit with 8.5 foot diameter steel penstock inside.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

A. Data Available

1. Hydrology and Hydraulics

Hydrologic and hydraulic design criteria and design data in the files of Pennsylvania Department of Environmental Resources (PennDER) was extensive. Refer to Section 5.1.A of this report for description of available data.

2. Embankment

The files of PennDER contained a full set of construction drawings including the results of test borings at the site. Design criteria for the embankment was not in the file.

3. Appurtenant Structures

Design criteria and design data for the appurtenant structures were not available in the files of PennDER. The only available design calculations were for the 8.5 feet diameter steel conduit, constructed in 1953. Construction detail drawings of all appurtenant structures and revisions made to the conduit in 1953 and 1976 were in the files.

B. Design Features

1. Embankment

The contract drawings show that the upstream section of the embankment was to be constructed of impervious material with a 3H to 1V upstream slope. All pervious material under this section was to be removed to the rock line (Appendix D, Plate VIII). In the approximate center of this excavation a concrete cutoff wall was constructed, keyed to a depth of 3.5 feet into the rock and extending 5 feet in the fill. This wall extends through the valley and up the steep western sidehill (Plate VII), but on the eastern hillside (left abutment) the cutoff wall is terminated at Station 14+00. The overburden here consists of sandy clay. The available drawings did not indicate that grouting was to be used and listing of bid items do not show an item for grouting. However, one progress report states that grouting under this wall was progressing with holes drilled at 3-foot centers. The upstream slope is protected against erosion by a 3-foot deep rock-facing placed on a 12-inch filter. The downstream section was constructed with more pervious material with

a slope of 2.5H to 1V. A rock toe was to be constructed with a top elevation between 710 and 740, presumably depending on available rock (Plate VIII, Appendix D). Drawings for construction of the steel conduit, constructed in 1953, show a rock toe extending to elevation 745 (Plate X) and is probably an as-built condition. Most of the fill material was supposed to come out of the excavation of the forebay and spillway. However, this material was too sandy to be used and the borrow material was increased from 150,000 cubic yards to 606,000 cubic yards.

2. Appurtenant Structures

a. Outlet Works

A 15-foot diameter conduit was constructed under the embankment. The conduit is a cast-in-place concrete pipe with a wall thickness of 3.5 feet in the center of the embankment and 3.0 feet at the ends. Joints and joint collars were placed at 30 feet centers. The conduit is resting on rock. At the upstream end is a reinforced concrete intake structure with a drop inlet at elevation 710. To prevent debris from entering the drop inlet, columns were placed on the edge of the inlet. An operator's platform was placed on top of the columns at elevation 722.0. The lower part of the intake structure was constructed with portholes to increase the discharge capacity during construction. After the construction of the embankment was completed, these lower holes were closed off with steel plates. The size of the conduit was based on requirements during construction rather than normal flow condition. A five foot square sluice gate was installed at invert elevation 682 to permit drawdown of the permanent pool below elevation 710. At the downstream end, the conduit discharges into a small concrete paved basin.

b. Spillway

The spillway is located in the left abutment. A large forebay area was excavated. The 300 feet long concrete ogee weir section has a four foot deep cutoff wall at the upstream end. Minimal reinforcement was placed in this section and the pours were 50 feet long. The joints were sealed with copper waterstops, but no keys are indicated. The reinforced concrete chute slab is 8 inches thick and has cutoff walls and a lateral drainage system. The chute walls are unreinforced concrete gravity sections. The only part of the spillway founded on rock is the flip bucket.

C. Design Data

1. Hydrology and Hydraulics

PennDER's report states that the spillway capacity to the top of dam equals 67,600 cfs, equal to 408 cfs per square mile or 5220

times the square root of the area. This report mentions that Lehigh University made a model test of the drop inlet structure and that the discharge with a pool level at top of dam would be approximately 4800 cfs. The design flood was equal to 64,200 cfs, leaving a freeboard of 1 foot.

2. Embankment

PennDER's files did not include design data or design criteria for the embankment. Borings and test pits are shown on the construction drawings.

3. Appurtenant Structures

Design criteria or design data for the appurtenant structures were not available for review in the PennDER files.

2.2 CONSTRUCTION

The files at PennDER contained construction photographs, progress reports and inspection reports. The construction drawings indicate that spoil areas were located immediately downstream of the rock toe. These areas were paved with riprap on a filter.

2.3 OPERATION

The main problem of operation for this facility is the collecting of debris around the intake structure. In 1953 a trash boom was installed, but this was destroyed in 1954. The park superintendent, Mr. Mansburger stated that the debris floats up when water rises and is deposited on the upstream slope. Debris is regularly removed. A gage well with a battery operated recorder is installed 15 feet downstream of the centerline dam (Plate X, Appendix D).

2.4 EVALUATION

A. Availability

The available engineering data was provided by PennDER Office of Dams and Encroachments.

B. Adequacy

1. Hydrology and Hydraulics

The available data included a stage discharge curve, stage design flood hydrograph and flood routing. The available data was sufficient to review the discharge capacity and storage capacity of this

project. Although hydraulic model tests were made on the drop inlet and conduit, it appears that the model did not include sufficient length of conduit to reflect actual condition. A serious cavitation problem occurred the first time a higher pool level was reached and several steel plates on the lower portholes blew out. Reports indicate also that the concrete quality was questionable. Further model tests indicated that a smaller diameter conduit would prevent cavitation.

2. Embankment

Although the design criteria and design data for the embankment fill were not available for review the design slopes are considered to be adequate and in accordance with accepted engineering practice. Construction reports indicate that initial problems with compaction were overcome by better control of moisture and additional passes with compaction equipment. The placing of a spoil area adjacent to the rock toe is questionable, except if this material was sufficiently pervious.

3. Appurtenant Structures

Design calculations of the appurtenant structures were not available for review. Sufficient details on the contract drawings are shown to evaluate these structures for structural adequacy. The spillway walls are gravity type and have sufficient base width for stability.

C. Operating Records

The available records indicate that cavitation caused considerable damage to the intake structure in November 1950 and March 1951 when pool level reached approximately elevation 754. No damage occurred to the conduit, but the downstream outlet channel was eroded. The tropical storm Agnes (June, 1972) caused a maximum discharge of 4.7 feet over the spillway. No damage to the spillway chute occurred, but the unprotected downstream area had considerable erosion. The upstream end of the steel conduit buckled. Repairs to conduit and the downstream channel were made and completed in 1977.

D. Post Construction Changes

The only reported modifications to the original dam design consisted of the installation of an 8.5 foot steel conduit inside the concrete conduit, filling the portholes of the intake structure with concrete and improving the orifice to the conduit.

E. Seismic Stability

The dam is located in Seismic Zone 1 and it is considered that the static stability with normal safety factors is sufficient to withstand minor earthquake induced dynamic forces. No calculations or studies have been made to confirm this.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

A. General

The general appearance of the dam and appurtenant structures is excellent. The normal pool is at elevation 710 (orifice inlet elevation) and creates a reservoir of 94 acres, with a maximum water depth of 20 feet. This lake is used for recreation (boating and swimming). The park area and the embankment are well maintained. The pool level was lowered about 4 inches below the drop inlet elevation to allow inspection of the conduit. The visual checklist is in Appendix A. Photographs taken during the inspection are reproduced in Appendix D, Plates III, IV, V and VI.

B. Embankment

The horizontal and vertical alignment of the embankment appeared to be excellent. The dam was constructed as a flood control project and most of the upstream slope is normally exposed. The cover consists of a rock blanket. Some weeds were growing on this slope, but the park superintendent, Mr. William Mansberger, stated that this growth is controlled on a yearly basis. The crest of the dam was in good condition. The downstream slope is covered with crown vetch and some weeds. Woodchuck holes noticed near the downstream toe, will have to be filled. Some seepage, estimated at 40 gallons per minute (57,000 gallons per day), appears at the left side of the conduit outlet below the toe of the embankment (Appendix D, Plate V) and flows over the outlet wingwall. The park superintendent indicated that there has been no change in flow over the years and the water was clear. The origin could be the rock toe or springs. It should be noted that the inspection was made with the pool level at about 85 feet below top of dam and that seepage conditions could increase during higher pool levels.

C. Appurtenant Structures

1. Spillway

A large forebay area was excavated and is seeded with grass. Some driftwood was piled up in the area, but will be removed. The right side has a curved concrete training wall, the left wall is straight. Some cracking was noticed in the walls, but none of the cracking appeared to affect the structural stability of the walls. Some differential movement at the top of the walls was noticed adjacent to the ogee section. This was caused by variation in support. All the monolithic ogee sections have a vertical crack in the center of the

pours, which were approximately 50 feet long. The center section had some horizontal cracking. None of the cracks appear to affect the structural integrity of the structure at the present time. Downstream damage occurred during the tropical storm Agnes (June 1972). The damage has been repaired and riprap has been placed at several locations (Appendix D, Plate VI). A bridge located downstream (Plate VII, Appendix D), was destroyed during that storm and has been replaced several hundred feet further downstream.

2. Intake Structure

The operator's platform is accessible from the crest of the dam by stairs leading down along the upstream slope and a footbridge at elevation 722.0. A valve stand on this platform controls a 5 foot by 5 foot sluice gate used to lower the pool below elevation 710. Normal pool level is controlled by the uncontrolled inlet opening at elevation 710. To prevent debris from entering the conduit, concrete columns are placed on top of the opening. Debris collects around the openings and is a constant maintenance problem. The park superintendent indicated that when pool level rises, the debris floats up and does not seriously effect the efficiency of the inlet. An upstream trash boom, which had been installed after construction was completed, was destroyed during a storm in 1954 and there are no present plans for replacing this trash boom.

3. Conduit and Conduit Outlet

The original construction included a 15 feet diameter concrete conduit which was first used during construction for diversion of stream and is connected directly to the intake structure for pool control after construction was completed. Cavitation during flood flows in 1950 and 1951 caused extensive damage. A new 8.5 foot diameter steel pipe, supported within the original conduit was installed. This steel pipe was damaged during the Agnes storm, but has since been repaired and performs in a satisfactory manner. The damage consisted of slight buckling of the steel plate near the orifice. Improved pipe supports were installed. The discharge through the 5 foot by 5 foot sluice gate runs between the concrete and steel conduit. The steel pipe was inspected and appeared in good condition. A small hole in the top of the pipe was discovered approximately 150 feet upstream from the end of the pipe. The outlet channel was in good condition.

D. Reservoir Area

The reservoir area of the normal pool is used as a park and is well maintained. Several buildings (restrooms and bathhouse) are located within the area which can be flooded. No sedimentation was reported by the park superintendent, but debris floats down during heavy precipitation and is deposited on the upstream embankment and other flooded areas.

E. Downstream Channel

The downstream channel is a natural stream in a relatively narrow valley. Most of the banks adjacent to the stream are wooded, but there are also open meadows. Little Pine Creek joins Pine Creek about 3.8 miles downstream at Waterville, Pennsylvania. It is estimated that there are about 80 permanent homes located between the dam and the mouth of Little Pine Creek, including houses in Waterville. The hazard category for this dam is considered to be "High", due to the expected additional loss of life if dam failure would occur after overtopping.

3.2 EVALUATION

The observed condition of the embankment and appurtenant structures appeared excellent at the time of inspection with a pool level at elevation 710(±).

The main concern is the possibility that the inlets on the intake structure will be jammed with debris. However, it appears unlikely that a 100 percent blockage would occur and the conduit discharge is only 4.4 percent of the total calculated discharge (Appendix B, Page 4).

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

Little Pine Creek Dam is a combination of a recreational facility and a flood control project. For recreational purposes, the normal pool elevation of 710.0 is maintained by an uncontrolled flow through the inlet structure and conduit. This outlet is the only available discharge until the pool rises above elevation 780.0 (spillway crest). The 5 foot sluice gate on the intake structure is only opened if the pool level has to be lowered below elevation 710.0. This gate cannot be operated after the pool level reaches an elevation in excess of 722.0.

4.2 MAINTENANCE OF DAM

The embankment is well maintained. Debris on the upstream slope is being removed as required and growth of weeds is controlled on an annual basis. The downstream slope has a heavy growth of crown vetch. Some woodchuck holes were noticed near the toe. These will be filled during the fall according to the Park Superintendent.

4.3 MAINTENANCE OF OPERATING FACILITIES

The only sluice gate is the 5 foot by 5 foot gate on the intake structure. This gate is operated on a monthly basis for flushing and to ensure an operable condition.

4.4 WARNING SYSTEM

There is no formal downstream warning system in effect. However, personnel were at the site during Agnes and informed downstream people when it was apparent that the pool level was going to reach the spillway crest.

4.5 EVALUATION

The general operational procedures at this dam are good. It is, however, recommended that a formal surveillance and downstream warning system be implemented to be used during periods of prolonged and heavy precipitation.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 EVALUATION OF FEATURES

A. Design Data

The hydrologic and hydraulic analysis available from PennDER for Little Pine Creek Dam was extensive. A stage-discharge curve, stage storage curve, design flood hydrograph and flood routing were all contained in the PennDER files.

The design flood hydrograph used by the designer was based on the estimated hydrograph for the flood of record prior to design (May 1946 storm). The same time base was used for the design hydrograph, but the discharge values were multiplied by a constant (3.17) to raise the peak discharge to the value obtained by the equation: Discharge = 5000 x $\sqrt{\text{(drainage area)}}$. The rainfall for the May 1946 storm was 6.05 inches, with about 80% being runoff. Multiplying this rainfall by the same constant indicates 19.2 inches of rainfall for the design storm. This seems low for a probable maximum flood and therefore, is inadequate for evaluating the safety of the dam.

B. Experience Data

The maximum flood experienced at Little Pine Creek Dam since it was constructed in 1950, occurred in June 1972. During this flood the pool level rose to 4.7 feet above the spillway crest. This storm was passed without difficulty.

C. Visual Observations

On the date of the inspection no conditions were observed that would indicate that the appurtenant structures of the dam could not operate satisfactorily during a flood event until the dam is overtopped.

D. Overtopping Potential

Little Pine Creek Dam has a total storage capacity of 35,500 acre-feet and the overall height is 113 feet above the streambed. These dimensions indicate a size classification of "Large". The hazard classification for this dam is "High" (See Section 3.1.E).

The recommended Spillway Design Flood (SDF) for a dam having the above classifications is the PMF (Probable Maximum Flood). For this dam the PMF peak inflow is 119,125 cfs (see Appendix B for hydraulic calculations).

Comparison of the estimated PMF peak inflow of 119,125 cfs with the estimated total discharge capacity of 70,750 cfs for spillway and drop inlet structure indicates that a potential for overtopping of the Little Pine Creek Dam exists.

An estimate of the storage effect of the reservoir shows that this dam does not have the necessary storage available to pass the PMF without overtopping. The spillway-reservoir system can pass a flood event equal to 74% of a PMF.

E. Spillway Adequacy

For Little Pine Creek Dam the PMF peak inflow is 119,125 cfs and the total discharge capacity with the water level at the top of the dam is about 70,750 cfs.

Since the spillway channel and conduit cannot pass the PMF peak inflow, it is considered to be inadequate, but not seriously inadequate.

The hydrologic analysis for this investigation was based upon existing conditions of the watershed. The effects of future development were not considered.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

A. Visual Observations

1. Embankment

There were no visual indications of undue embankment stresses or sloughage. The embankment was in excellent condition, except for a small amount of seepage water near the conduit outlet which is apparently originating from the toe drain and some woodchuck holes. It should be noted that the dam was inspected with normal pool without critical seepage conditions.

2. Appurtenant Structures

Visual observations indicate no present stability or stress problems in any of the appurtenant structures.

B. Design and Construction Data

1. Embankment

There were no design criteria or design data available for review. The typical section shown on *Plate VIII, Appendix D*, indicates a well engineered section with a concrete cutoff wall in the impervious section. The files contained many soil compaction test reports indicating that placing of fill was conducted under good supervision. Filters are indicated between rock facing and embankment material. The normal pool level is 85 feet below top of dam. The design detailed on the drawings is considered to be adequate.

2. Appurtenant Structures

A review of the design drawings indicate that all structures were designed and detailed according to acceptable engineering standards. The gravity type walls have a base width of at least half the height and have a drainage system behind the walls. The spillway slab has cutoff walls and a drainage system. Due to the length of pours of the ogee section, cracking has occurred.

C. Operating Records

While no formal operating records were reviewed, the only reported major problem occurred in the orifice of the inlet structure, due to cavitation. The new steel conduit appears to have solved this

problem. Downstream erosion during the tropical storm Agnes was limited to washouts of riprap opposite the spillway and around the conduit outlet.

D. Post Construction Changes

The only reported modifications made to the original dam and appurtenant structures consisted of the installation of a 8.5 foot diameter pipe in the conduit and necessary changes in the orifice.

E. Seismic Stability

This dam is located in Seismic Zone No.1 and it is considered that the static stability is sufficient to withstand minor earthquake induced dynamic forces. However, no calculations, studies, etc., were made to confirm this conclusion.

SECTION 7 - ASSESSMENT AND RECOMMENDATIONS

7.1 DAM ASSESSMENT

A. Safety

The visual inspection, the review of available design data and the operational history indicates that the dam is in excellent condition and has been constructed in accordancee with acceptable engineering practice.

The results of the hydrologic and hydraulic evaluation indicate that the spillway does not have the capacity to pass the PMF without overtopping the dam and is, therefore, inadequate. It will, however, with available storage pass 74 percent of the PMF and on the basis of this, the capacity is considered to be inadequate but not seriously inadequate.

B. Adequacy Of Information

The information available in the files is considered to be adequate for assessing the condition of this facility within the scope of the Phase I inspection.

C. Urgency

It is considered that the recommendations made in this section be implemented as soon as possible.

D. Necessity for Additional Studies

Additional studies are not required at this time. However, attention should be given to the recommendations presented in this section.

7.2 RECOMMENDATIONS

A. Facilities

In order to assure a continued satisfactory operation of this dam, the following recommendation is made for action by the owner:

1. Consideration should be given to the installation of a trash boom to prevent clogging of the intake structure.

2. The quantity and turbidity of the seepage exiting at the toe of the dam should be monitored and recorded. Changes in conditions under higher pool level should be noted, to determine if an in-depth study of the seepage condition is required.

B. Operation and Maintenance Procedures

It is considered important that the owner develop a formal surveillance and downstream warning system to be used during periods of high and prolonged precipitation.

APPENDIX A

VISUAL CHECKLIST

CHECK LIST - DAM INSPECTION PROGRAM

PHASE I - VISUAL INSPECTION REPORT

NAD NO. 351

PA. ID # 41-91 NAME OF DAM Little Pine Creek Dam HAZARD CATEGORY High

TYPE OF DAM: Earth and Rockfill

LOCATION: Cummings TOWNSHIP Lycoming COUNTY, PENNSYLVANIA

INSPECTION DATE 9-8-78 WEATHER Cloudy - Light Rain TEMPERATURE 70's

INSPECTORS: H. Jongsma, R. Houseal D.E.R.

R. Shireman, A. Bartlett Bill Mansberger
Dick Rahn
Neal Carson

NORMAL POOL ELEVATION: 710.0 AT TIME OF INSPECTION:

BREAST ELEVATION: 795.0 POOL ELEVATION: 709.3

SPILLWAY ELEVATION: 780.0 TAILWATER ELEVATION:

MAXIMUM RECORDED POOL ELEVATION: 784.7 (1972 Agnes)

GENERAL COMMENTS:

Drainage Area - 165 Sq.Mi.
Earthfill - 890,000 C.Y.
Rockfill - 140,000 C.Y.
Concrete 20,000 C.Y.

Seepage at left side of outlet below toe of embankment.
Steady flow - clear - park superintendent indicated no change in flow over long period of time.
This condition on record - appears to come from toe drain or springs.
Estimated 40 gpm± not measured.

DAM NO. NAD 351

VISUAL INSPECTION

EMBANKMENT	OBSERVATIONS	REMARKS & RECOMMENDATIONS
A. SURFACE CRACKS	None evident.	
B. UNUSUAL MOVEMENT BEYOND TOE	None evident.	
C. SLOUGHING OR EROSION OF EMBANKMENT OR ABUTMENT SLOPES	None evident.	
D. VERTICAL & HORIZONTAL ALIGNMENT OF CREST	Good.	
E. RIPRAP FAILURES	None evident	
F. JUNCTION EMBANKMENT & ABUTMENT OR SPILLWAY	Good	
G. SEEPAGE	Water pool level low on upstream of embankment. Some water in toe drain. See Page 1.	
H. DRAINS	Refer to drawings.	
J. GAGES & RECORDER	Gage well - on top to measure pool level.	
K. COVER(GROWTH)	Upstream - rock surface - weeds growing through. Downstream - Crown vetch - weeds over rock surface. Top - grass at edges - 1/2" stone at center.	

DAM NO. NAD 351

VISUAL INSPECTION

OUTLET WORKS	OBSERVATIONS	REMARKS & RECOMMENDATIONS
A. INTAKE STRUCTURE	Drop inlet - with tower for normal pool level.	
B. OUTLET STRUCTURE	Concrete headwall with side walls discharging into pool then to natural stream.	
C. OUTLET CHANNEL	Concrete walls with concrete end sill. Walls in good condition.	
D. GATES	One - 5' x 5' gate. Access to gate through the deck of the tower.	
E. EMERGENCY GATE	None - above gate not accessible during a flood event.	
F. OPERATION & CONTROL	Gate open only for inspection. Normal discharge is over the drop inlet on its own as the pool level changes. Opened at least once a month.	
G. BRIDGE (ACCESS)	Steps down embankment to bridge onto tower. Staff gage on outlet.	

DAM NO. NAD 351

VISUAL INSPECTION

SPILLWAY	OBSERVATIONS	REMARKS & RECOMMENDATIONS
A. APPROACH CHANNEL	Forebay area raised above normal pool Grassed area - Left side is exposed rock. - Right side is curved concrete wall. Training walls cracked - not seriously. Slight movement of walls to different support at ogee.	
B. WEIR: Crest Condition Cracks Deterioration Foundation Abutments	Concrete ogee section with sloped approach slab Uncontrolled Monolithic pours have cracked One section considerable Horizontal cracking.	
C. DISCHARGE CHANNEL Lining Cracks Stilling Basin	Concrete slabs and walls. Some minor cracks. Channel slopes to arched section at end. Walls in good condition. Discharges to excavated natural ground.	
D. BRIDGE & PIERS	None	
E. GATES & OPERATION EQUIPMENT	None	
F. CONTROL & HISTORY	4.7' over spillway during 1972 Agnes	

DAM NO. NAD 351

VISUAL INSPECTION

MISCELLANEOUS	OBSERVATIONS	REMARKS & RECOMMENDATIONS
INSTRUMENTATION		
Monumentation	None	
Observation Wells	None	
Weirs	None	
Piezometers	None	
Other	Battery operated tape gage.	
RESERVOIR		
Slopes	Wooded & lawn - picnic area.	
Sedimentation	Silt removed, partially by C of E after Agnes (recreational problem)	
DOWNSTREAM CHANNEL		
Condition	Natural mountain stream.	
Slopes	Wooded	
Approximate Population	250	
No. Homes	80 permanent including Waterville.	

APPENDIX B

HYDROLOGY/HYDRAULICS

BY RLS DATE 9/19/78 **BERGER ASSOCIATES** SHEET NO. 1 OF
CHKD. BY DJK DATE 9/21/78 PROJECT 07530
SUBJECT LITTLE PINE CREEK DAM

MAXIMUM KNOWN FLOOD AT DAMSITE

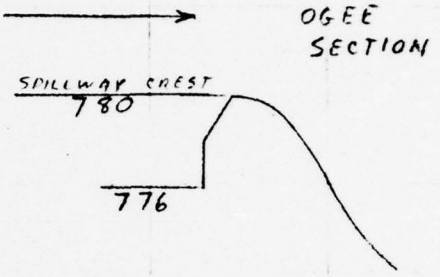
THE STATE RECORDS INDICATE THAT THE MAXIMUM FLOOD AT LITTLE PINE CREEK DAM, SINCE ITS CONSTRUCTION IN 1950, OCCURRED IN JUNE 1972. AT THAT TIME THE WATER LEVEL IN THE POOL REACHED AN ELEVATION 4.7' HIGHER THAN THE SPILLWAY CREST.

$L = 300'$
$H = 4.7'$
$C = 3.88$

$Q = C L H^{3/2}$

$Q = 3.88 \times 300 \times (4.7)^{3/2}$

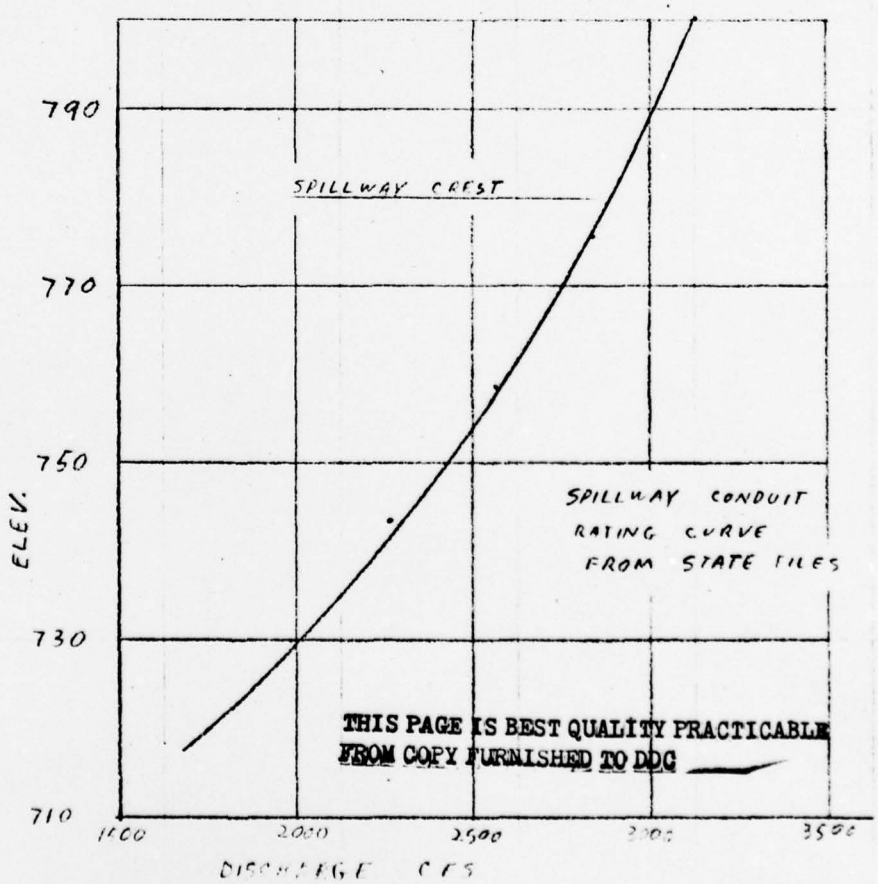
$= 11860$ CFS OVER SPILLWAY



C = 3.88
(FIG. 249 DESIGN OF SMALL DAMS AND USED BY DESIGNER)

PLUS 2950 CFS THROUGH SPILLWAY CONDUIT

TOTAL FLOW =
11860 + 2950
= 14810 CFS



BY RLS DATE 9/11/78 **BERGER ASSOCIATES** SHEET NO. 2 OF
CHKD. BY DJR DATE 9/21/78 PROJECT D7530
SUBJECT LITTLE PINE CREEK DAM

DISCHARGE THROUGH OUTLET WORKS

OUTLET CONDUIT IS SECTOR OF ANNULUS BETWEEN OLD SPILLWAY CONDUIT AND NEW SPILLWAY CONDUIT.

$A = 22.1$ SF
$P = 22.3'$
$R = .991$
$N = .015$
$L = 598' \pm$
ASSUME DOWNSTREAM HEAD = 687

POOL AT NORMAL LEVEL 710
$H = 710 - 687 = 23$
$S = .0385$

$$Q = \frac{1.486}{N} A R^{2/3} S^{1/2}$$

$= 427$ CFS

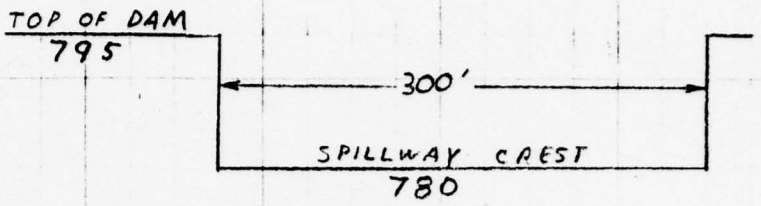
LOW POOL AT ELEV 690
$H = 690 - 687 = 3$
$S = .00502$

$$Q = \frac{1.486}{N} A R^{2/3} S^{1/2}$$

$= 154$ CFS

BY RLS DATE 9/12/78 **BERGER ASSOCIATES** SHEET NO. 3 OF
CHKD. BY DJR DATE 9/21/78 PROJECT D 7530
SUBJECT LITTLE PINE CREEK DAM

SPILLWAY CHANNEL CAPACITY

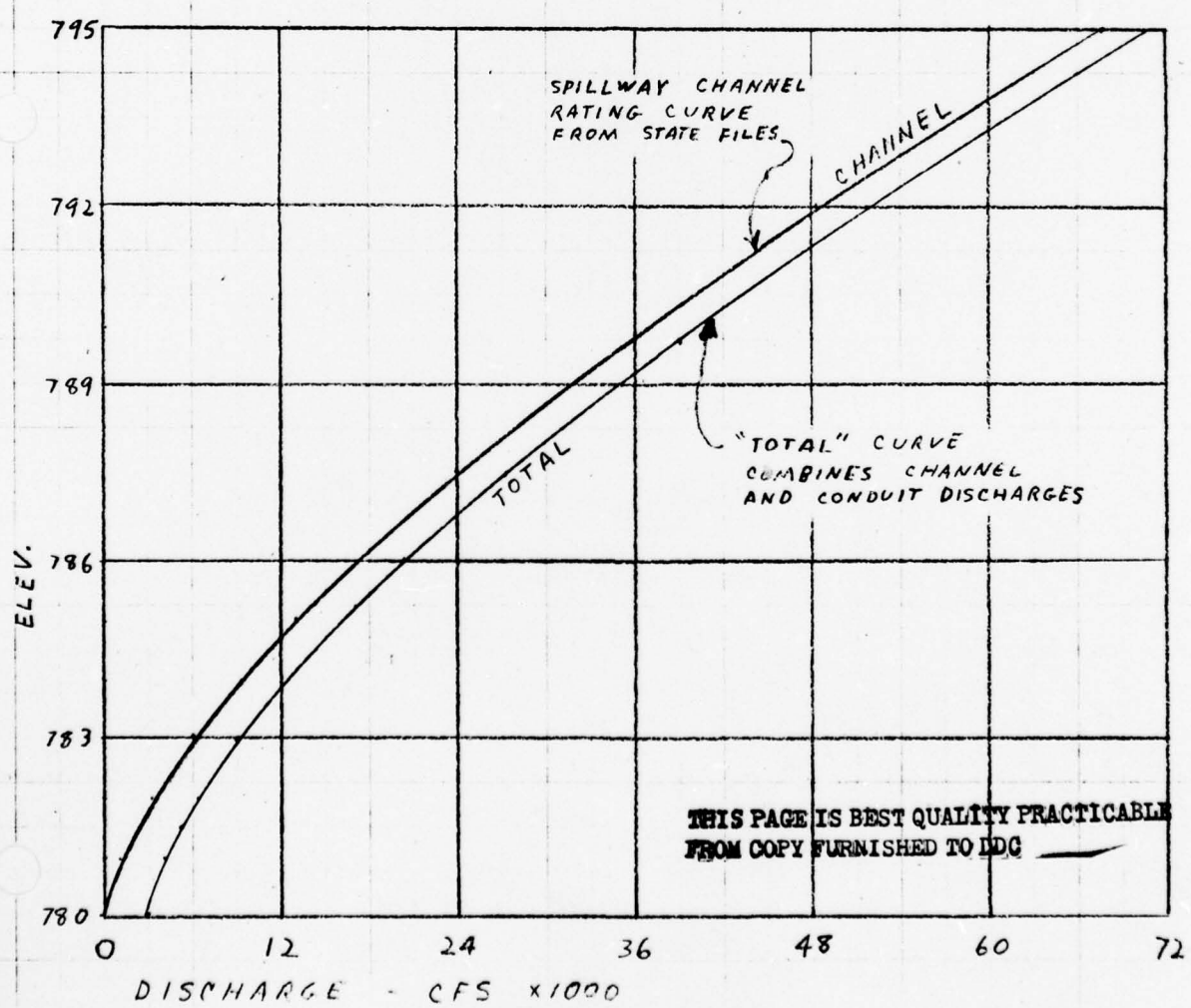


$L = 300'$
$H = 15'$
$C = 3.88$

$Q = C L H^{3/2}$

$= 3.88 \times 300 \times 15^{3/2} = 67620$ CFS

TOTAL DISCHARGE CAPACITY = CHANNEL + CONDUIT
= 67620 + 3130 = 70750 CFS



BY RLS DATE 10/19/78 **BERGER ASSOCIATES** SHEET NO. 4 OF
CHKD. BY DATE PROJECT
SUBJECT LITTLE PINE CREEK DAM

SIZE CLASSIFICATION

MAXIMUM STORAGE = 35500 ACRE-FEET
MAXIMUM HEIGHT = 113 FEET
SIZE CLASSIFICATION IS "LARGE"

HAZARD CLASSIFICATION

SEVERAL HOUSES BUILT ALONG STREAM DOWNSTREAM OF DAM. USE "HIGH".

RECOMMENDED SPILLWAY DESIGN FLOOD

THE ABOVE CLASSIFICATIONS INDICATE USE OF AN SDF EQUAL TO THE PROBABLE MAXIMUM FLOOD.

PMF

DRAINAGE AREA = 165.4 SQ. MI.

PMF PEAK FOR ALVIN R. BUSH DAM = 154000 CFS
DRAINAGE AREA FOR BUSH DAM = 228 SQ. MI.

TRANSPOSE TO LITTLE PINE

$$\left(\frac{165.4}{228}\right)^{0.8} \times 154000 = 119125 \text{ CFS}$$

VOL. OF INFLOW = 26" = 229355 AC-FT

$$\frac{\text{MAXIMUM SPILLWAY DISCHARGE}}{\text{PEAK INFLOW}} = \frac{70750}{119125} = .594 \quad \text{SAY } 59\%$$

$$\frac{\text{REQD. RES. STORAGE}}{\text{VOL. OF INFLOW}} = .406 \quad \text{(FROM C. OF E. SHORTCUT FLOOD ROUTING METHOD)}$$

REQD. RES. STORAGE = .406 x VOL. OF INFLOW
= .406 x 229355
= 93118 AC-FT

BY RLS DATE 9/19/78 R 10/18/78 **BERGER ASSOCIATES** SHEET NO. 5 OF
CHKD. BY DJR DATE 9/21/78 PROJECT D 7530
SUBJECT LITTLE PINE CREEK DAM

STORAGE AVAILABLE BETWEEN CONDUIT LEVEL (710)
AND TOP OF DAM (795)
= 35500 − 1100 = 34400 AC-FT

34400 < 93118 ∴ DAM WILL BE OVERTOPPED BY PMF

FOR 65% PMF
65% PEAK INFLOW = .65 × 119125 = 77431 CFS
VOLUME OF INFLOW = .65 × 229355 = 149081 AC-FT

$$\frac{\text{MAX. SPILLWAY DISCHARGE}}{\text{65\% PEAK INFLOW}} = \frac{70750}{77431} = .914$$

$$\frac{\text{REQD. RES. STORAGE}}{\text{VOL. OF INFLOW}} = .086 \quad \text{(FROM SHORTCUT METHOD)}$$

REQD. RES. STORAGE = .086 × VOL. OF INFLOW
= .086 × 149081
= 12863 AC-FT

FOR 80% PMF
80% PEAK INFLOW = .80 × 119125 = 95300 CFS
VOL. OF INFLOW = .80 × 229355 = 183484 AC-FT

$$\frac{\text{MAX. SPILLWAY DISCHARGE}}{\text{80\% PEAK INFLOW}} = \frac{70750}{95300} = .742$$

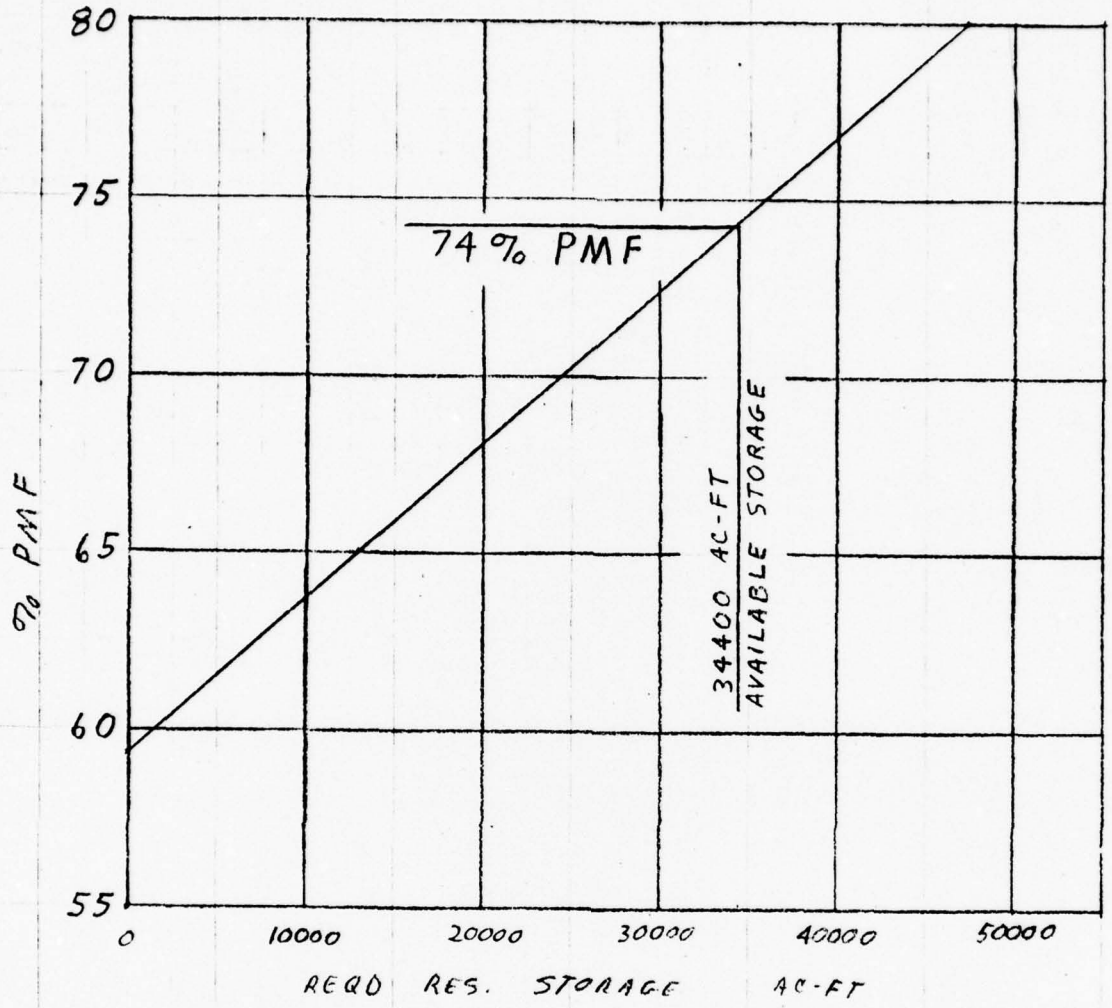
$$\frac{\text{REQD. RES. STORAGE}}{\text{VOL OF INFLOW}} = .258 \quad \text{(FROM SHORTCUT METHOD)}$$

REQD. RES. STORAGE = .258 × VOL. OF INFLOW
= .258 × 183484
= 47267 AC-FT

BY BLS DATE 9/15/78 R 10/18/78 **BERGER ASSOCIATES** SHEET NO. 6 OF

CHKD. BY DJR DATE 9/21/78 PROJECT D7530

SUBJECT LITTLE PINE CREEK DAM



LITTLE PINE CREEK DAM IS ABLE TO PASS 74% OF A PMF WITHOUT OVERTOPPING.

APPENDIX C

GEOLOGICAL REPORT

GEOLOGIC REPORT

Bedrock - Dam and Reservoir

Formation Name: Catskill Formation, upper red bed member.

Lithology: The upper red bed member of the Catskill Formation consists of repeated cycles of interbedded sandstones and shales. Each cycle (where complete) consists of the following lithologies, from the base up:

1. Thick, massive gray sandstone.
2. Brown sandstone.
3. Fine grained red sandstone and siltstone.
4. Very silty red shale.
5. Thick red mudstone.
6. Thin green shale.

Each cycle is about 50 feet thick.

Locally, there are lenses of conglomerate with calcareous cement at the base of the gray sandstone unit. Elsewhere, the cement of the sandstones is not calcite.

Structure

Little Pine Creek valley is an area of very gentle folding. True dips are generally less than 5°. The dam is located just northwest of the axis of the Jersey Mills syncline. Structure contours (Ref.1) strike N80°E and the dip is about 2-1/2°. Air photo fracture traces are difficult to detect on the available photographs, scale 1:70,000. Three fractures were noted, N86°E, N70°W and N22°W.

Overburden

The valley of Little Pine Creek is filled with sand and gravel, derived from the glaciated areas in the upper reaches of Little Pine Creek. The core borings for this dam indicate that this alluvium is 8 to 25 feet thick. However, the author of this report had the opportunity to visit the site during construction. Excavation for the core trench exposed a buried stream valley, or inner gorge, that was filled with the same alluvium. There, the total thickness must have been close to 50 feet thick.

The valley sides are covered with colluvium and talus. The boring logs call this "gravel" also. On the east side of the valley, in the spillway area, this overburden is 50 to 75 feet thick.

The bedrock beneath the overburden was apparently fresh, little fracturing was noted.

Aquifer Characteristics

The sandstones, siltstones and shales of the Catskill Formation generally have little or no, primary permeability. Locally, the sandstones may have some permeable zones, but in general, ground water movement is along bedding planes and along joints. Most movement is along these paths in the sandstone units, as the fractures and bedding planes in the shales tend to be clogged with clay.

Discussion

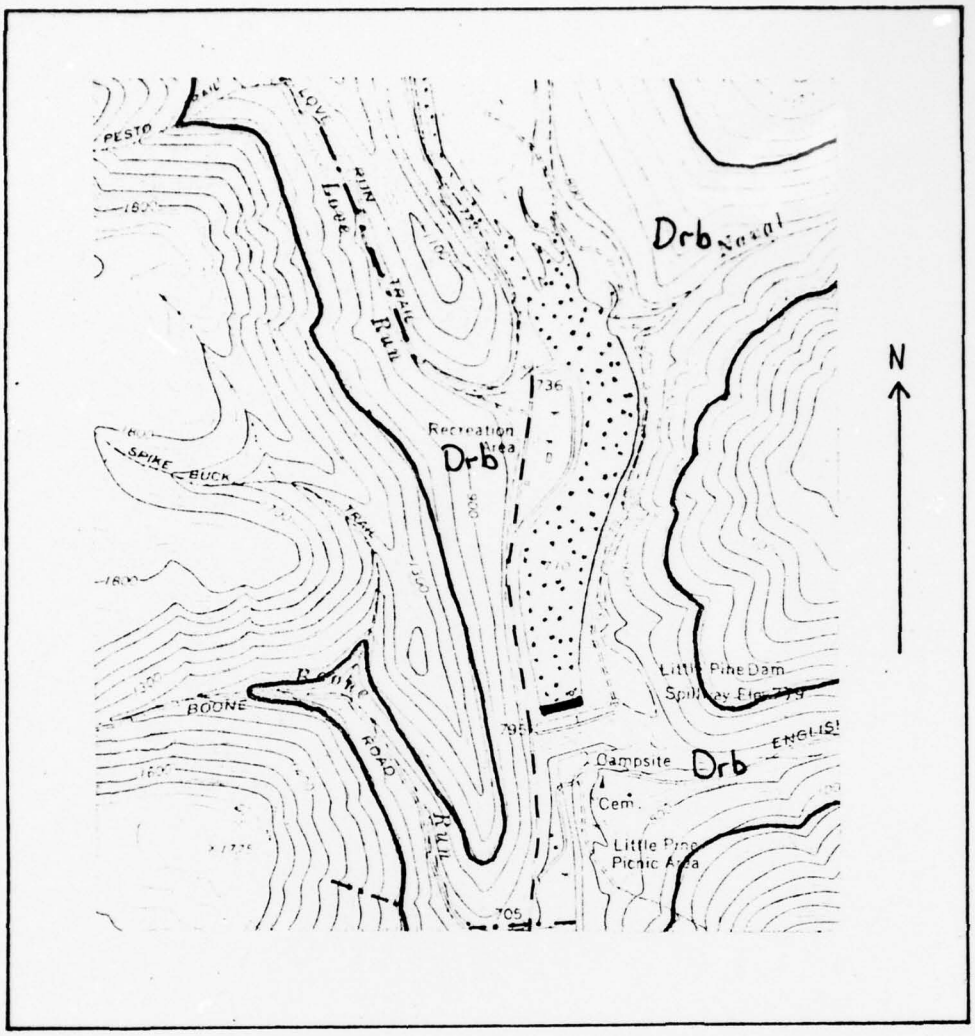
The cut-off trench was dug into fresh bedrock. Little, or no fracturing, was noted in the core logs. Ground water movement along bedding planes beneath the grout curtain is possible, but the gentle dip of the beds from the reservoir toward the dam would inhibit this movement. The rock is sound, and has very little carbonate cement. Continued movement of ground water is unlikely to cause any deterioration of the rock.

Sources of Information

1. Colton, G.W. (1968) "Bedrock Geology of the Waterville Quadrangle Lycoming County, Pa." Pa. Geological Survey, 4th Series, Progress Report 174.

2. Air photographs, scale 1:70,000, dated 1973.

3. Core boring logs in file.



(geology from Pa. Geol. Surv. Progress Report 174)

KEY

Drb — Catskill Fm.- upper red bed member

—·—·—· air photo fracture trace

SCALE 1:24 000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

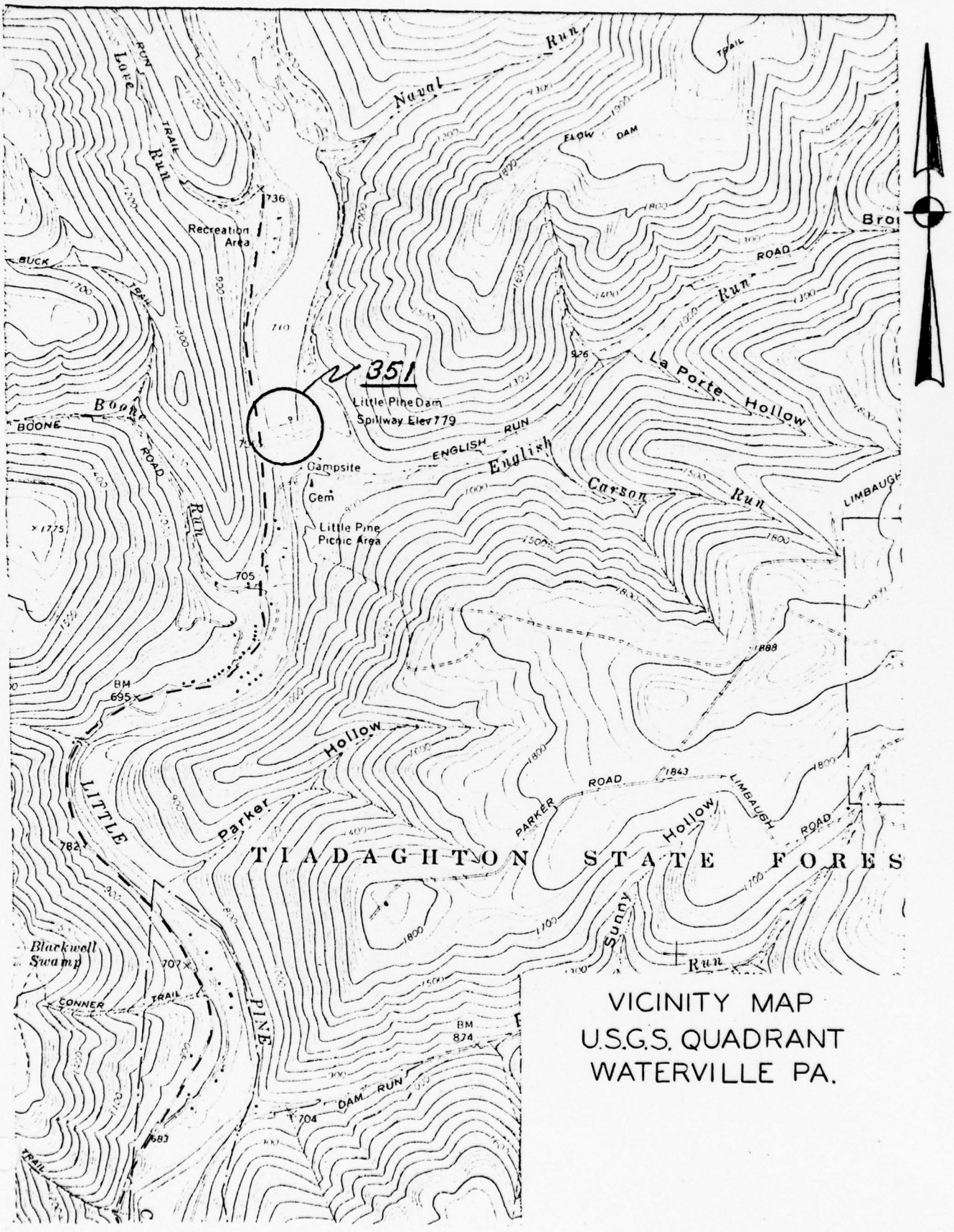
CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

APPENDIX D

LOCATION, PHOTOGRAPHS & DESIGN DRAWINGS

LOCATION PLAN
LITTLE PINE CREEK DAM

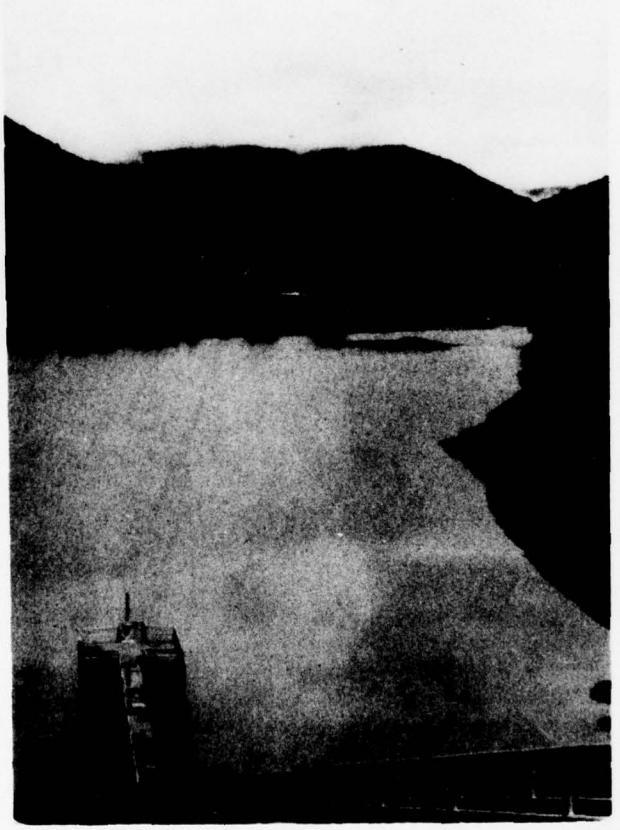
PLATE I



VICINITY MAP
U.S.G.S. QUADRANT
WATERVILLE PA.

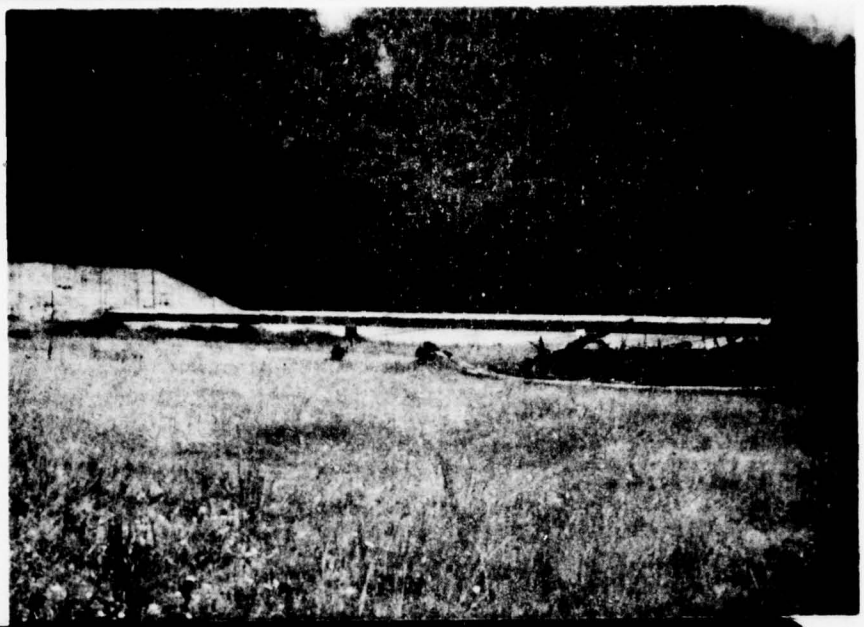
PLATE II

Upstream Slope & Intake Structure

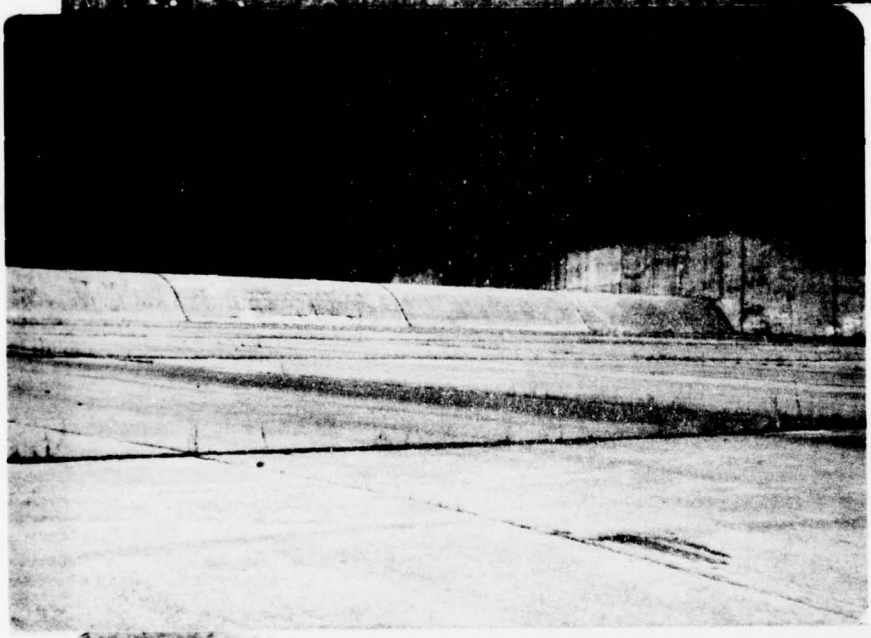


Reservoir & Stairs to Intake Structure

Plate III



Forebay

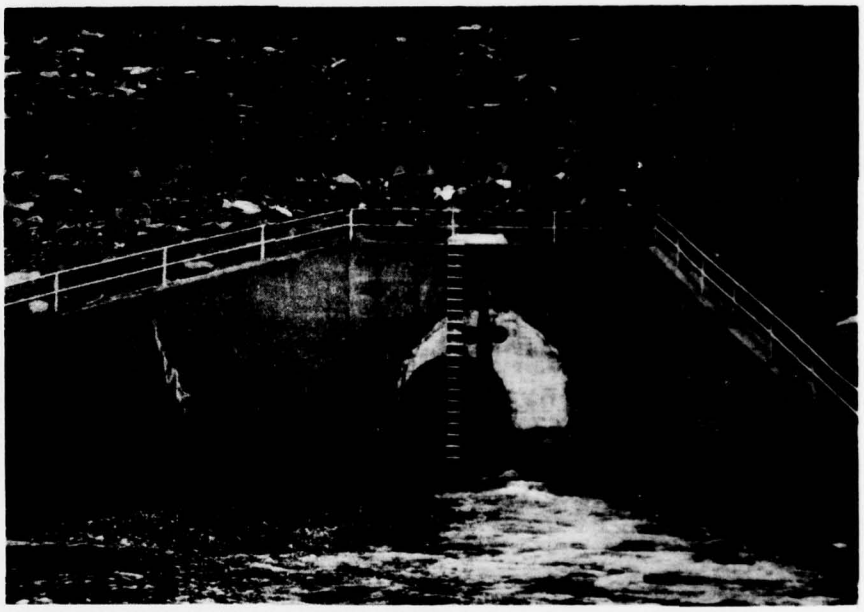


Spillway

Downstream Slope
& Spillway

Plate IV

Conduit Outlet and Spillway

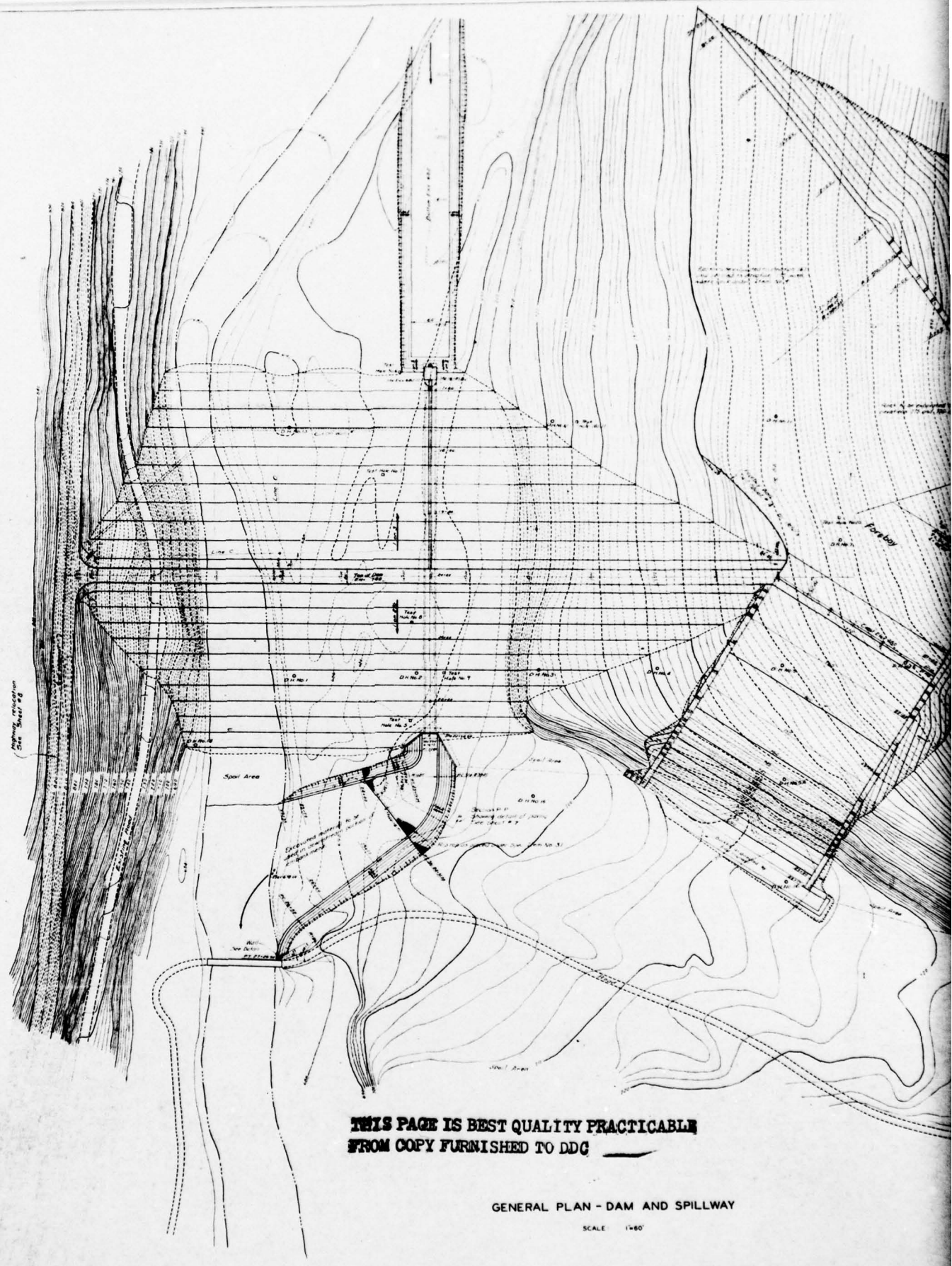


Outlet Steelpipe in Conduit

Spillway Discharge Channel

Downstream Channel

Plate VI



GENERAL PLAN - DAM AND SPILLWAY

SCALE 1"=60'

351

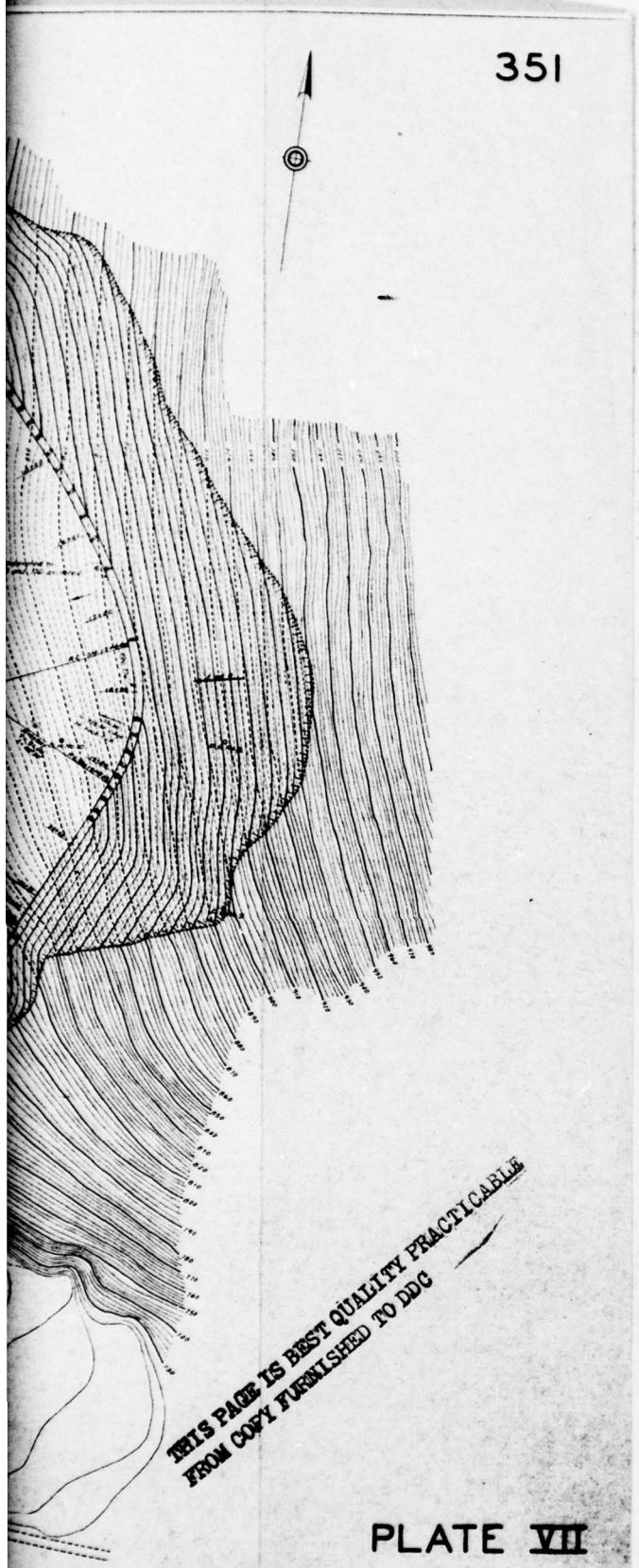
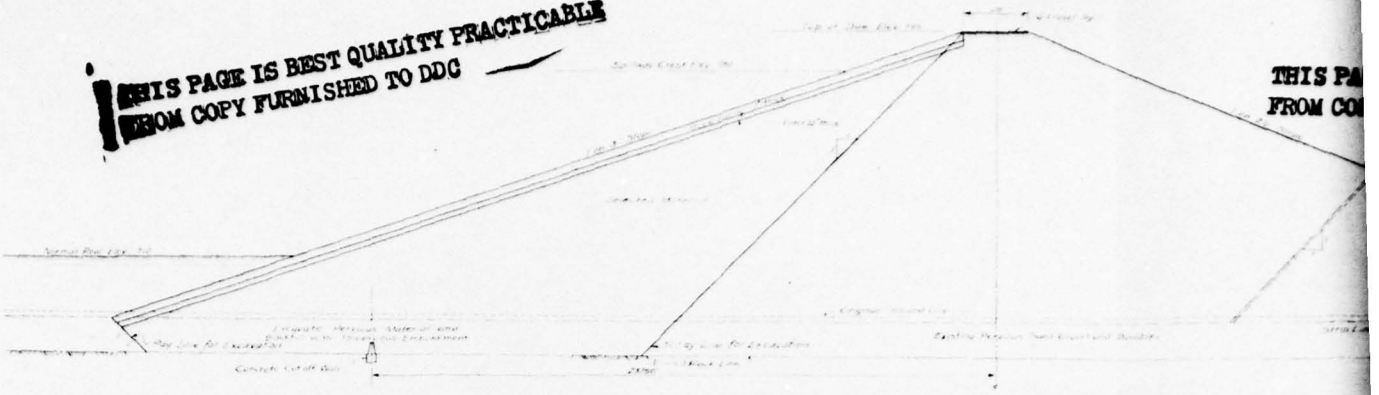
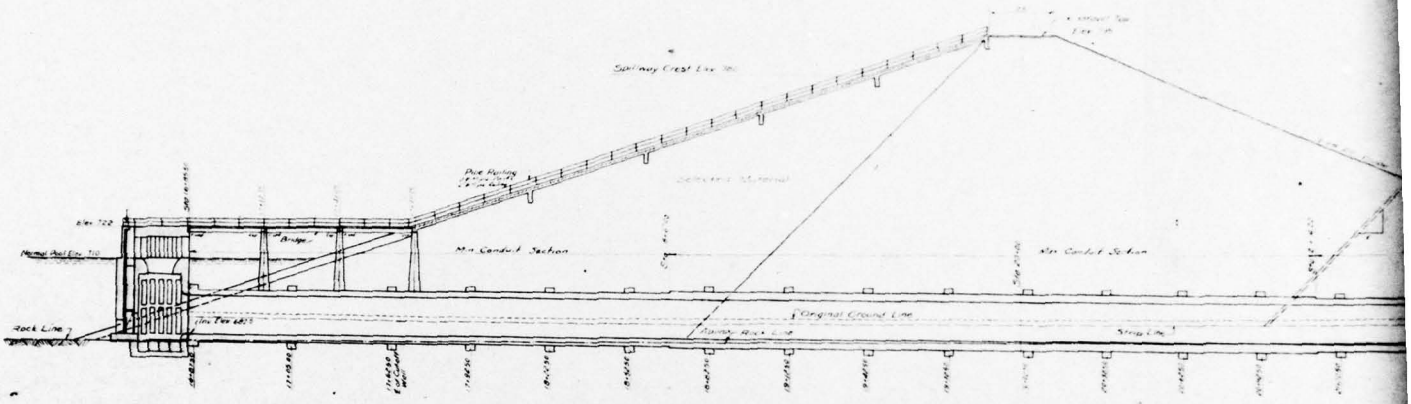


PLATE VII

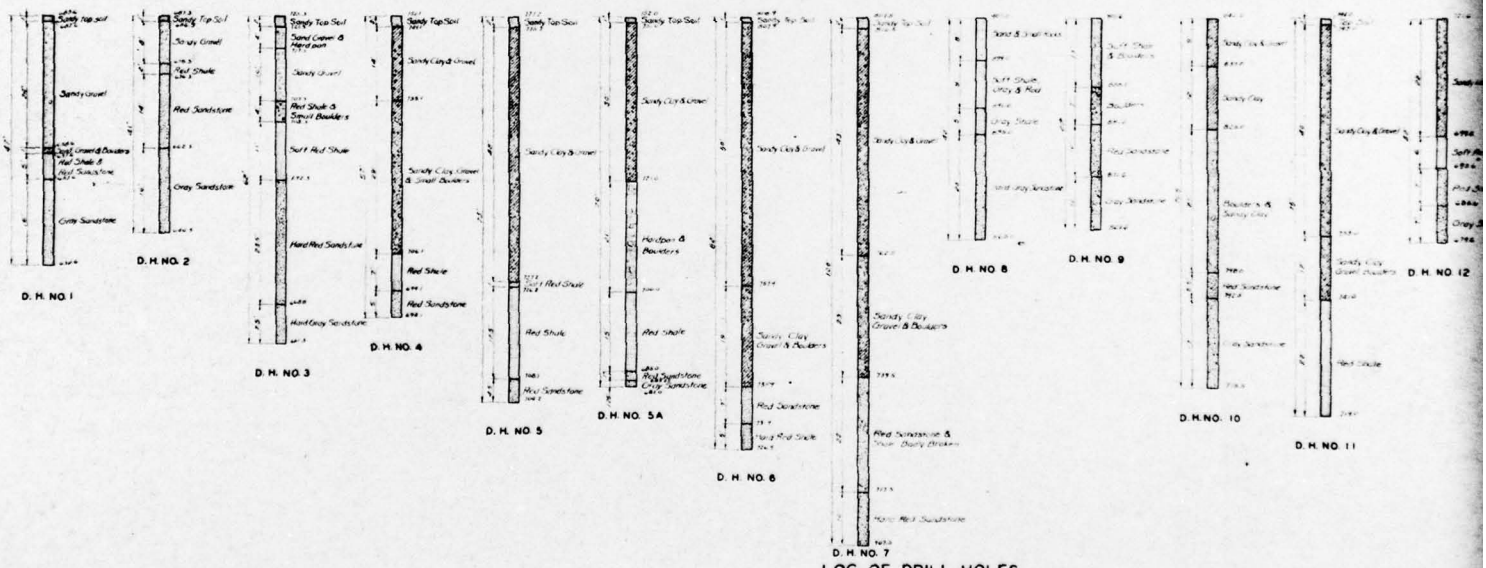
SUBMITTED J. D. Carpenter GARNETT FLEMING CONDRON & CARPENTER INC. CONSULTING ENGINEERS	LITTLE PINE CREEK DAM
APPROVED CHIEF ENGR. DEPT. OF FORESTS & WATERS	GENERAL PLAN DAM & SPILLWAY
APPROVED SECRETARY DEPT. OF FORESTS & WATERS	SCALE 1" = 100'
APPROVED GOVERNOR	DATE 11-12-48
ACCEPTED CONTRACTOR	COMMONWEALTH OF PENNA DEPT OF FORESTS & WATERS HARRISBURG PA.
	SHEET NO. 2



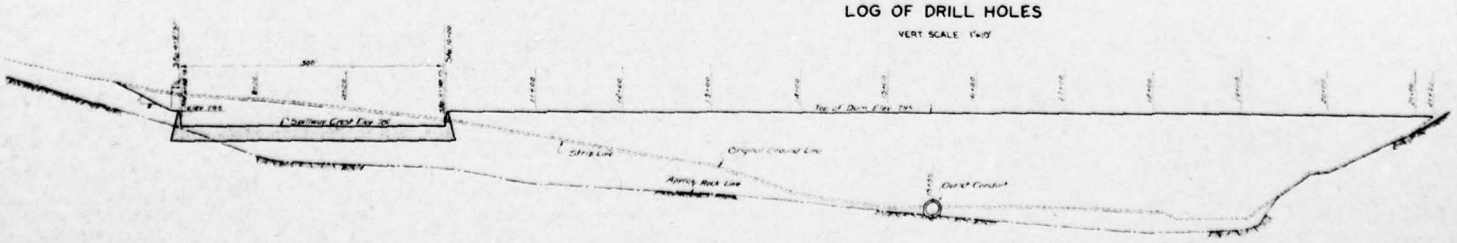
TYPICAL SECTION THROUGH DAM
SCALE 1"=20'



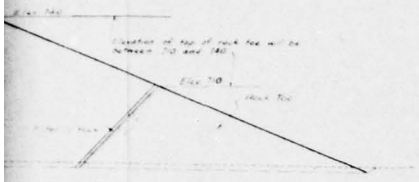
SECTION THROUGH OUTLET STRUCTURE
SCALE 1"=20'

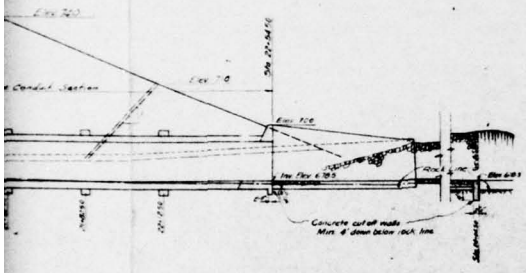


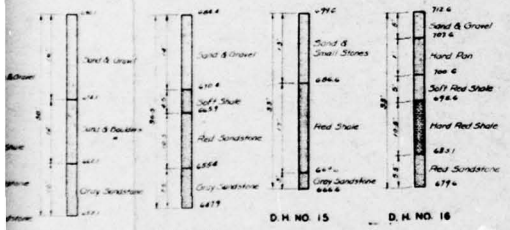
LOG OF DRILL HOLES
VERT. SCALE 1"=10'



LONGITUDINAL SECTION THROUGH CENTER LINE OF DAM
SCALE 1"=60'



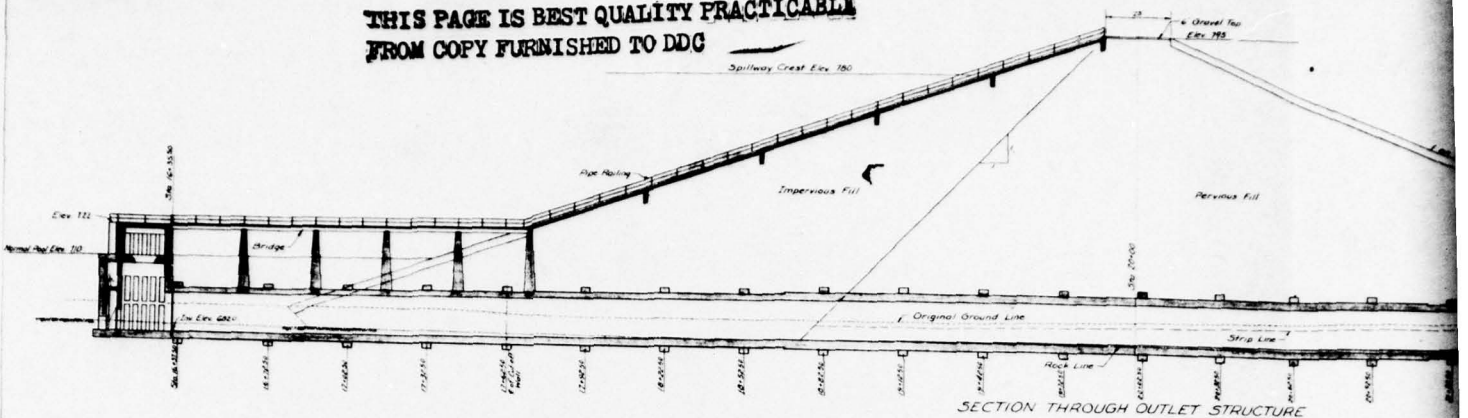




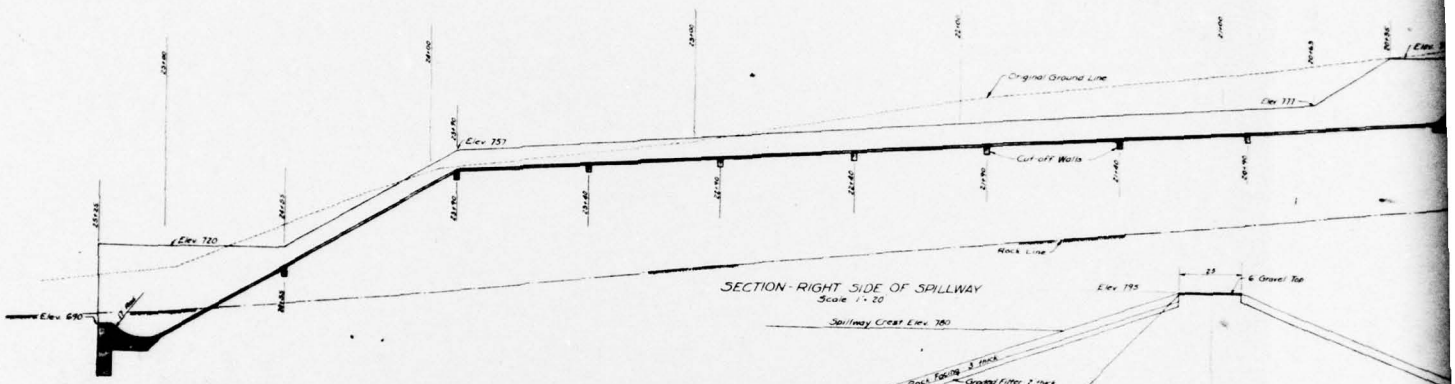
D. H. NO. 13 D. H. NO. 14 D. H. NO. 15 D. H. NO. 16

PLATE VIII

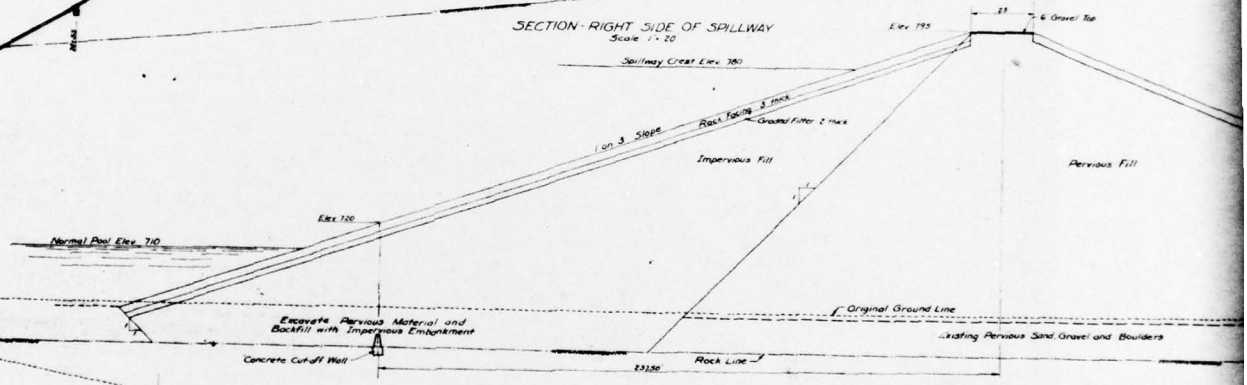
SUBMITTED J. D. Carpenter GANNETT FLEMING CORDDRY & CARPENTER, INC. CONSULTING ENGINEERS	LITTLE PINE CREEK DAM
APPROVED CHIEF ENGR. - DEPT. OF FORESTS & WATERS	SECTIONS AND LOG OF DRILL HOLES
APPROVED SECRETARY - DEPT. OF FORESTS & WATERS	SCALE - AS SHOWN
APPROVED GOVERNOR	DATE 11-12-48 / COMMONWEALTH OF PENNA DEPT. OF FORESTS & WATERS HARRISBURG, PA. / SHEET NO. 3
ACCEPTED CONTRACTOR	



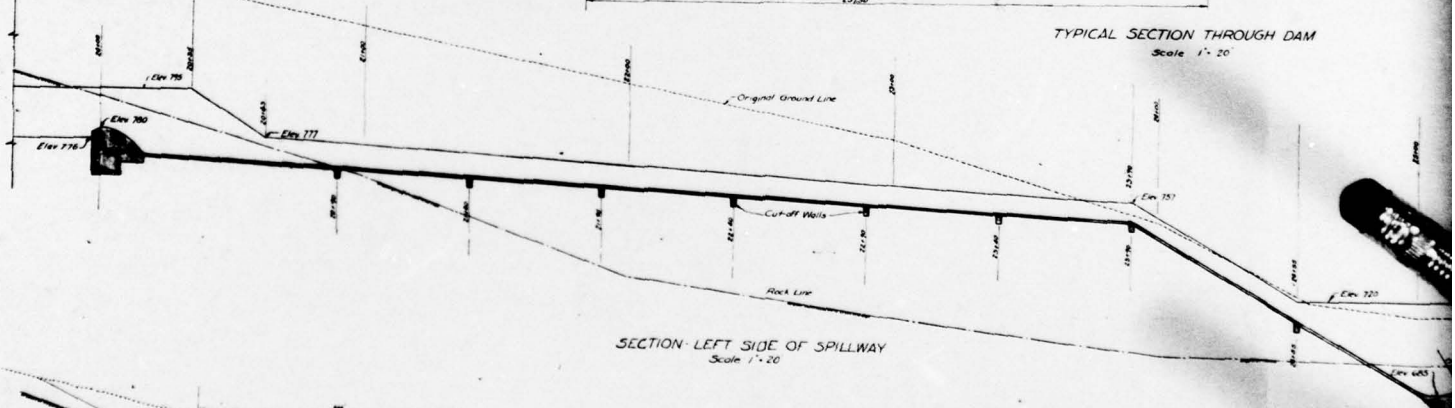
SECTION THROUGH OUTLET STRUCTURE
Scale 1" = 20'



SECTION - RIGHT SIDE OF SPILLWAY
Scale 1" = 20'

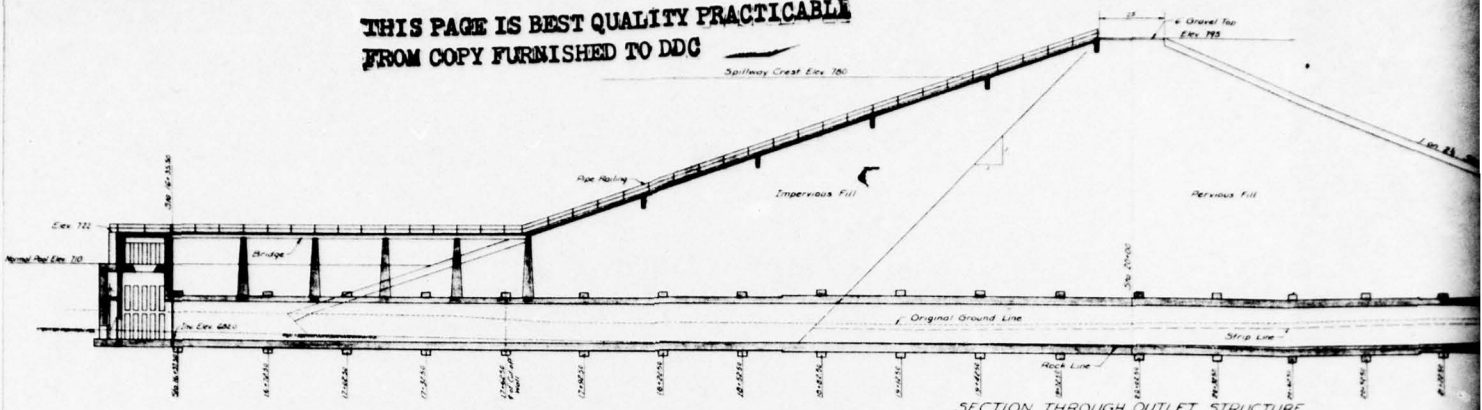


TYPICAL SECTION THROUGH DAM
Scale 1" = 20'

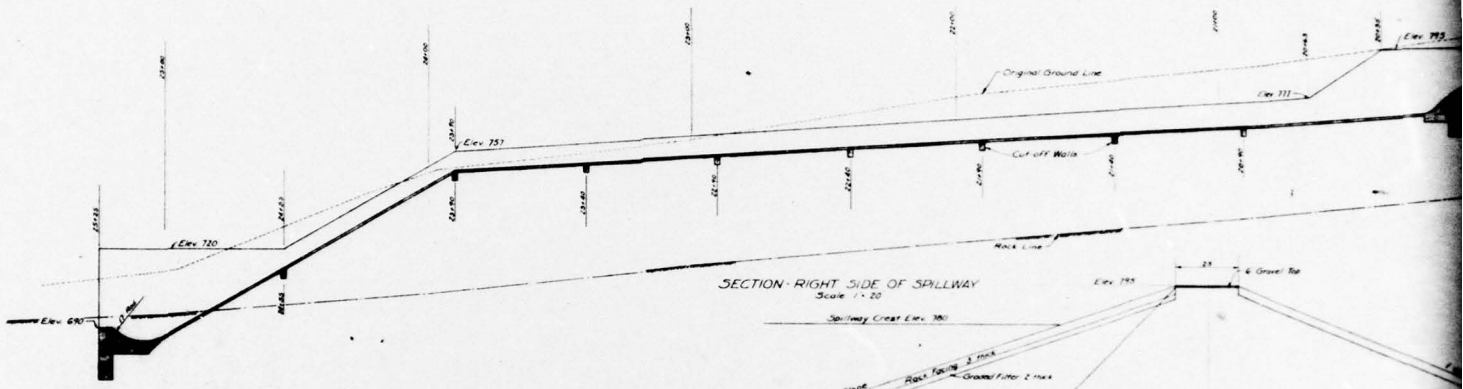


SECTION - LEFT SIDE OF SPILLWAY
Scale 1" = 20'

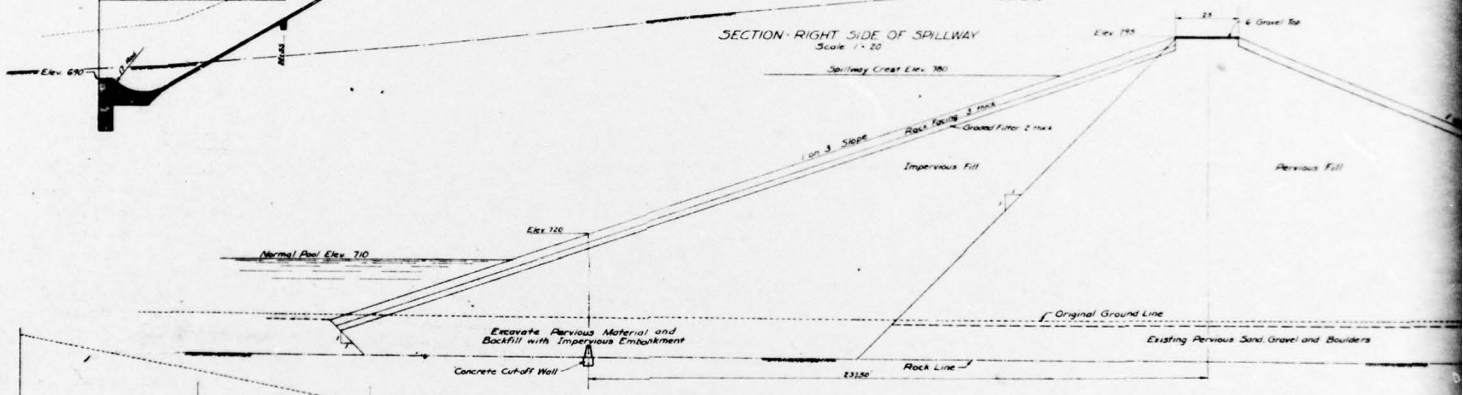
LONGITUDINAL SECTION THROUGH CENTER LINE OF DAM
Scale 1" = 60'



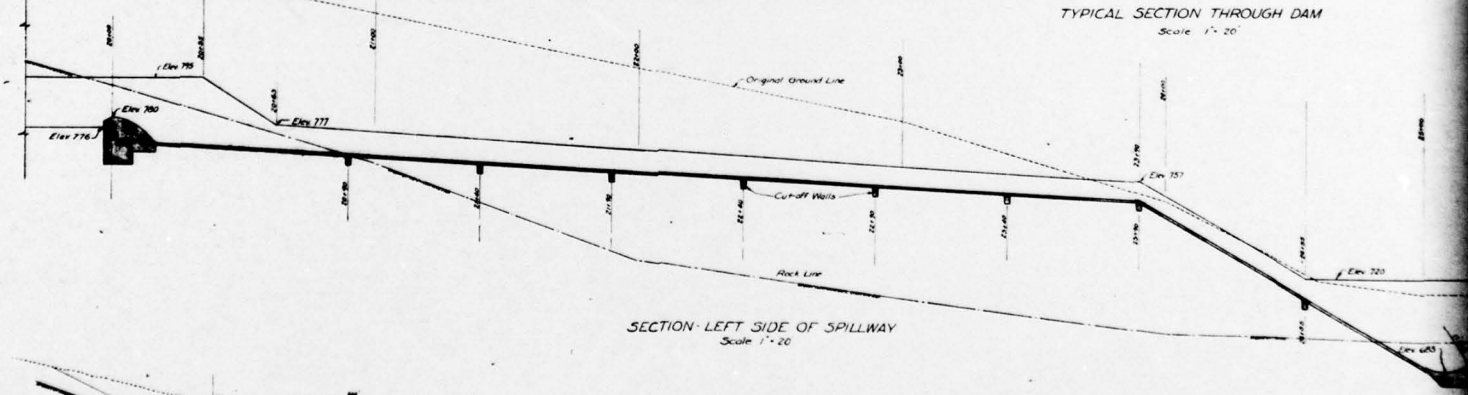
SECTION THROUGH OUTLET STRUCTURE
Scale 1" = 20'



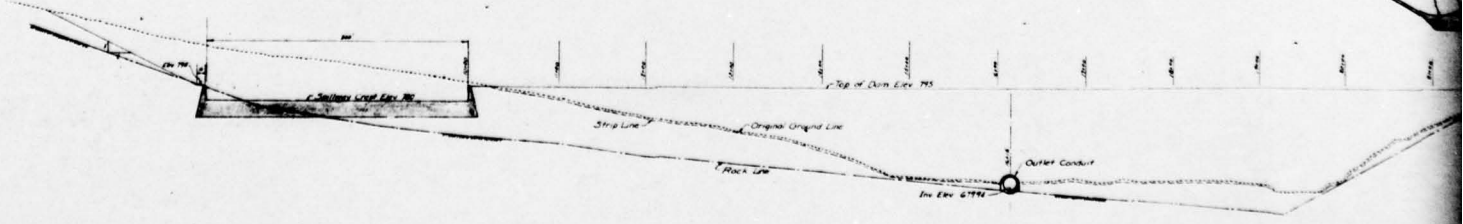
SECTION - RIGHT SIDE OF SPILLWAY
Scale 1" = 20'



TYPICAL SECTION THROUGH DAM
Scale 1" = 20'



SECTION - LEFT SIDE OF SPILLWAY
Scale 1" = 20'



LONGITUDINAL SECTION THROUGH CENTER LINE OF DAM
Scale 1" = 60'

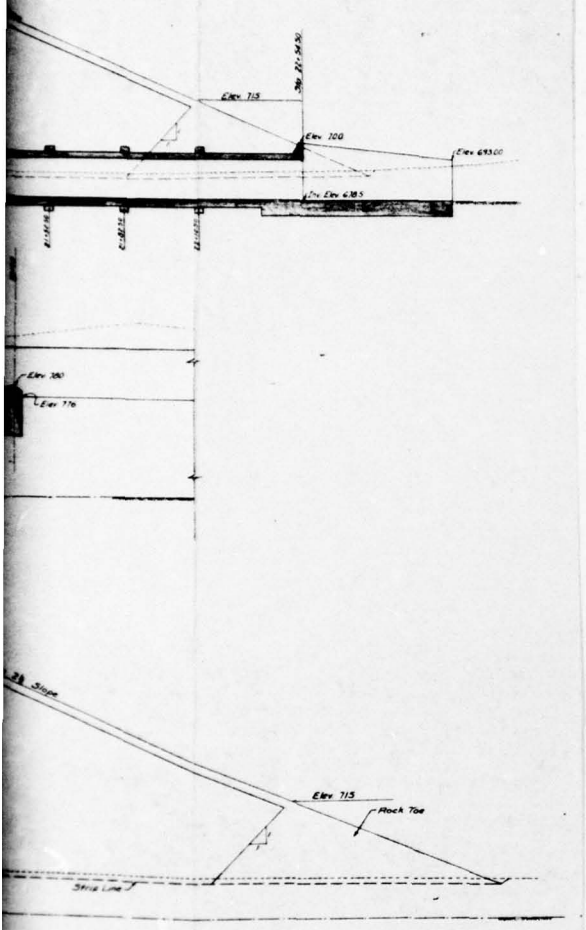
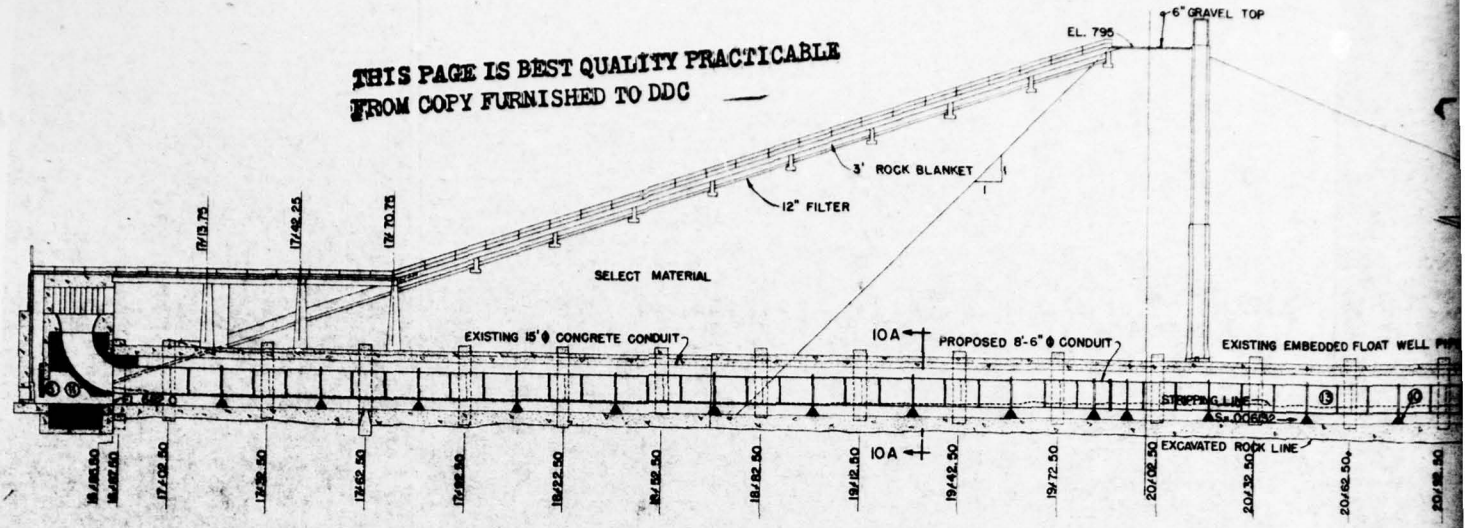
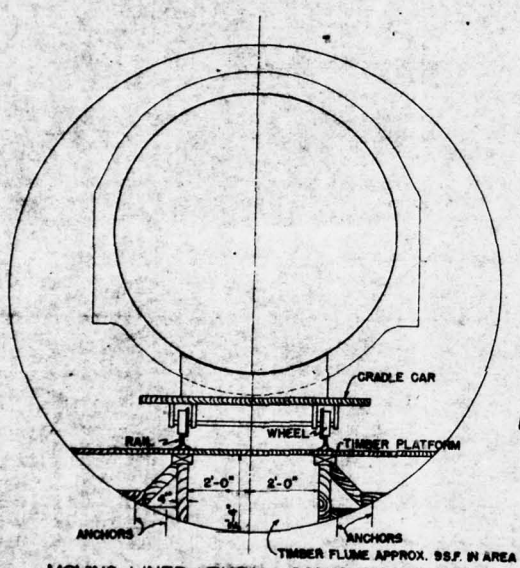


PLATE IX

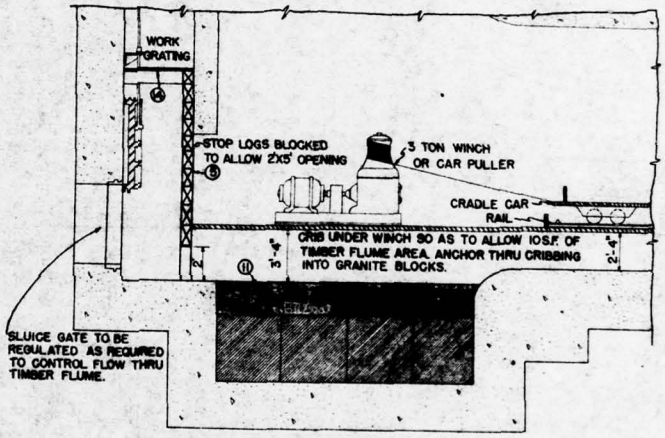
SUBMITTED GANNETT FLEMING CORDDRY & CARPENTER, INC. CONSULTING ENGINEERS	LITTLE PINE CREEK DAM	
APPROVED CHIEF ENGR. DEPT. OF FORESTS & WATERS	SECTIONS & PROFILES	
APPROVED SECRETARY, DEPT. OF FORESTS & WATERS	SCALE - AS SHOWN	
APPROVED GOVERNOR	DATE	SHEET NO. 3
ACCEPTED CONTRACTOR	COMMONWEALTH OF PENNA DEPT. OF FORESTS & WATERS HARRISBURG, PA.	



SECTION THRU OUTLET STRUCTURE



MOVING LINER THRU CONCRETE CONDUIT
SCALE: 1/2"=1'-0"



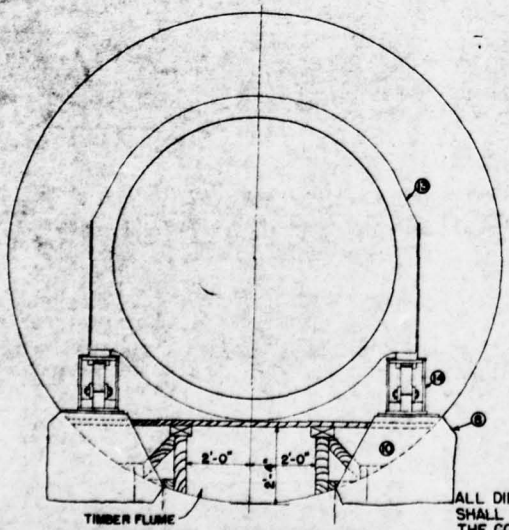
GATE ENTRANCE & CAR PULLER
SCALE: 1/4"=1'-0"

SUGGESTED P

1. REMOVE REMAINS OF THE 4 CONC... OF INTAKE STRUCTURE BETWEEN EL...
2. FILL AND LEVEL A WORK AREA ADJ... EL. 692.62. SPACE SHOULD BE ALLOWE... COFFERDAM, IF STREAM CONDITION AT... ABOVE EL. 692.62 WILL BE REQUIRED. ... BELOW EL. 692.62 SHOULD REMAIN ...
3. CLEAN MATERIAL FROM STREAM BE... SHOWN ON PLANS, IN ORDER TO REDU...
4. SELECT PERIOD OF EXPECTED LOW ...
5. WHILE GATE IS CLOSED, CLEAN DEB... DRILL REQUIRED LOW LYING ANCHOR ... QUICK SETTING, HIGH EARLY STRENG... WINCH OR CAR PULLER AT THIS TIME. ... OVER THE FRESH CONCRETE FOR 10... IT SHOULD BE NECESSARY TO KEEP ...
6. OPEN GATE AND ALLOW POOL TO B...
7. CLOSE GATE AND CONSTRUCT CRI... ALSO CONSTRUCT CRIBBING ACROSS ... ADJACENT TO ENGLISH RUN. THE WOR... STRUCTURE SHOULD BE INSTALLED AS... AS TO RESTRICT THE WATER ENTRANC...
8. OPEN THE SLUICE GATE AND ALLOW ... FLOW COMPLETE CONSTRUCTION OF T... BLOCK OUT PIER LOCATIONS SO THAT ... REQUIRED. INSTALL CAR PULLER.
9. STEEL LINERS RECEIVED ON JOB IN ... ADJACENT TO ENGLISH RUN.
10. PLACE 30 FOOT SECTION ON CRADLE ... STILLING BASIN AND THRU CONDUIT INT... UPSTREAM END AND WORK DOWNSTRE...
11. RAISE STEEL PIPE WITH JACKS AND P... CAR LEAVES THE CONDUIT BY GRAVITY ...
12. LOWER PIPE, AND BRING INTO FINAL ... OF JACKS, WEDGES, ETC. EXERCISE CA... WILL BE APPROXIMATELY PLUMB WHEN ... (THIS IS CONSIDERED TO BE A MEAN ...
13. AFTER PIPE IS COMPLETELY INSTALL... INSIDE OF CONDUIT), REMOVE WINCH F... 9'-4½" X 15'-0" OPENING ABOVE EL. 692.... OPENING. THE ELBOW SECTIONS CAN B... AT EL. 710, AND ERECTED INTO FINAL PO... FLUME.
14. CONSTRUCT UPSTREAM CONCRETE, A... FROM INTAKE STRUCTURE.
15. PAINT OUTER SURFACE OF PIPE BE... INNER SURFACE CAN BE PAINTED AT ... DEFERRED UNTIL LATER.
16. CONSTRUCT DOWNSTREAM CONCR...

GENERAL NOTE

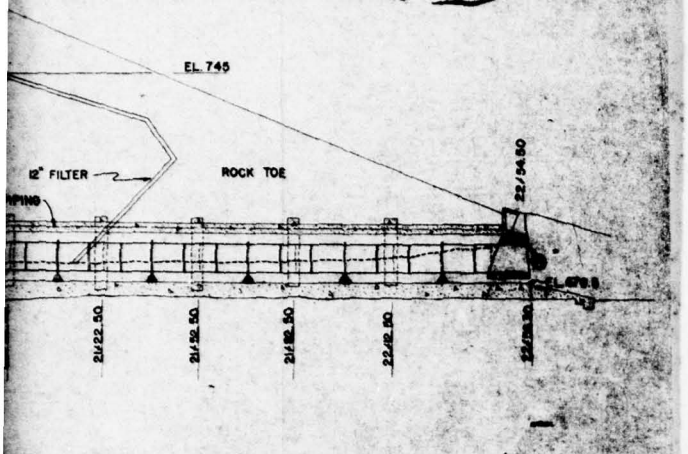
1. THE PROCEDURES DETAILED ON THIS SHEET ARE SUGGESTED ONLY AS A METHOD OF PREFORMING THE REQUIRED WORK AND IS NOT INTENDED TO PROHIBIT THE CONTRACTOR FROM PROPOSING ALTERNATE PROCEDURES FOR ACCOMPLISHING THE SAME OBJECT.
2. FIGURES IN CIRCLES INDICATE ITEM NUMBER UNDER WHICH PAYMENTS WILL BE MADE.
3. SECTION INDICATED AS 10A INDICATES THAT SECTION WILL BE FOUND ON SHEET NO. 10



LINER AT SETTING POINT
SCALE: 1/2"=1'-0"

ALL DIMENSIONS AND EXISTING CONDITIONS SHALL BE CHECKED AND VERIFIED BY THE CONTRACTOR AT THE SITE.

REVI



PROCEDURE

CRETE COLUMNS FROM RIGHT SIDE
LEVATIONS 692.62 AND 702.0
DJACENT TO SIDES OF INTAKE STRUCTURE TO
ED FOR POSSIBLE CONSTRUCTION OF A
T TIME OF WORK INDICATE THAT PROTECTION
STEEL PLATES, ATTACHED TO STRUCTURE
IN PLACE.
ED DOWNSTREAM OF STILLING BASIN, AS
DUCE TAIL WATER DEPTH.
W FLOW AND CLOSE 5'X5' SLUICE GATE.
BRIS FROM INTAKE STRUCTURE AND CONDUIT,
R BARS AND PLACE FLOOR SLAB EMPLOYING
ITH CONCRETE. PROVIDE ANCHOR BARS FOR
E. WATER SHOULD NOT BE ALLOWED TO RUN
HOURS AFTER COMPLETION OF PLACEMENT.
THE GATE CLOSED BETWEEN 24 & 36 HOURS.
DRAIN.
ING AND TIMBER FLUME IN INTAKE STRUCTURE
STILLING BASIN TO WORK AND STORAGE AREA
RK GRATING AT ELEVATION 694 IN INTAKE
AND THE STOP LOGS PLACED AND SO BLOCKED
NCE TO 10 S.F.
POOL TO DRAIN THEN WITH A CONTROLLED
TIMBER FLUME, WORK PLATFORM, AND CAR RAIL
THEY CAN BE CONSTRUCTED IN THE DRY, AS

N 30' SECTIONS AND UNLOADED IN WORK AREA

LE CAR AND PULL CAR ALONG TRACK ACROSS
NTO APPROXIMATE FINAL POSITION. START AT
EAM.
REMOVE CRADLE CAR AND RAIL. CRADLE
TY.
L POSITION ON PIERS AND ROCKERS, BY USE
RE IN SPACING RINGS SO THAT ROCKER BENTS
THE PIPE IS AT A TEMPERATURE OF 60°F.
BETWEEN SUMMER AND WINTER TEMPERATURES).
LED (30 FOOT SECTIONS WELDED TOGETHER
FROM INTAKE STRUCTURE (BY WAY OF THE
.62) AND PUT SECTIONS OF ELBOW THRU
BE POSITIONED, BY CABLES THRU THE ORIFICE
POSITION WITHOUT DISTURBING THE TIMBER

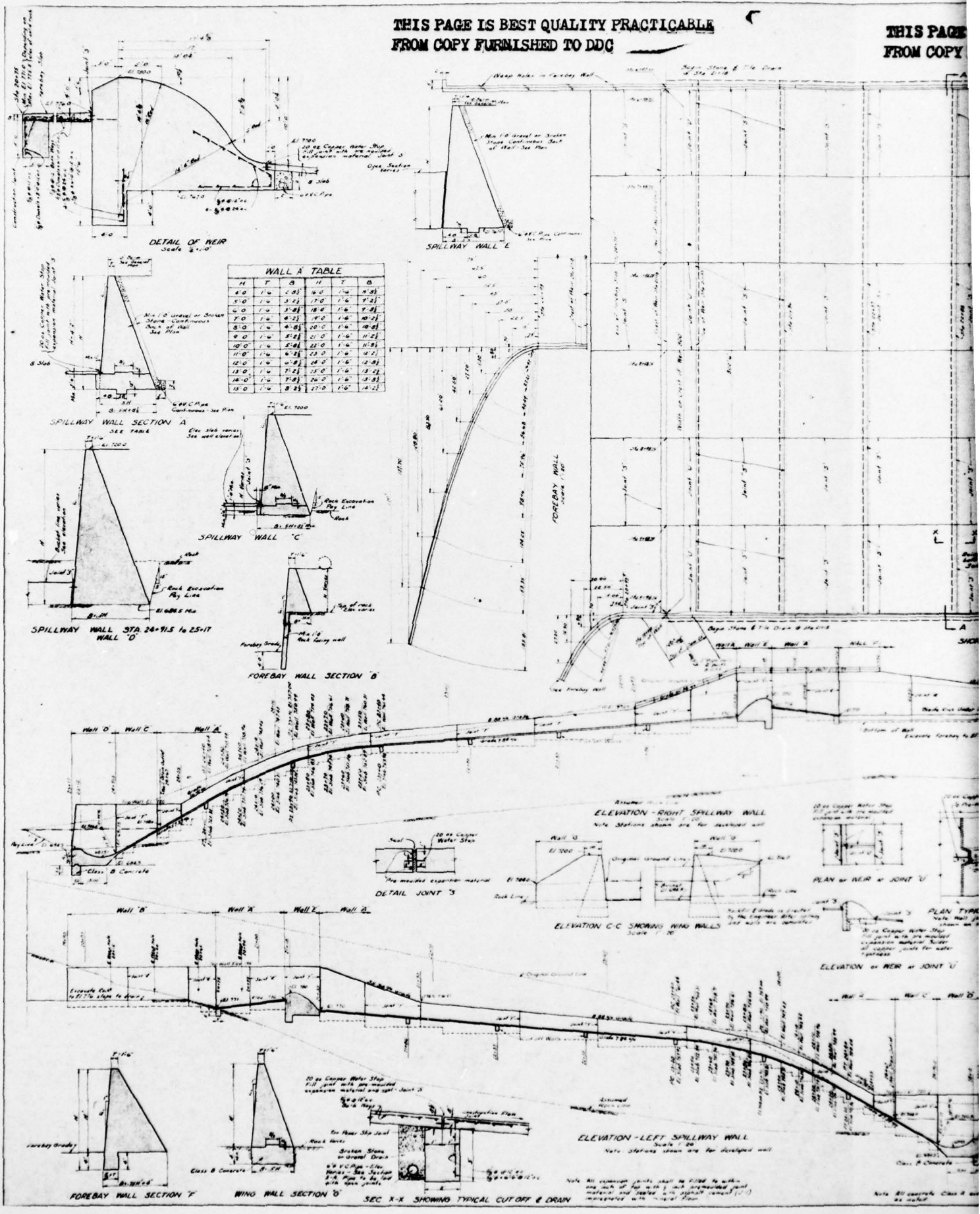
, AS DETAILED, AND REMOVE TIMBER FLUME

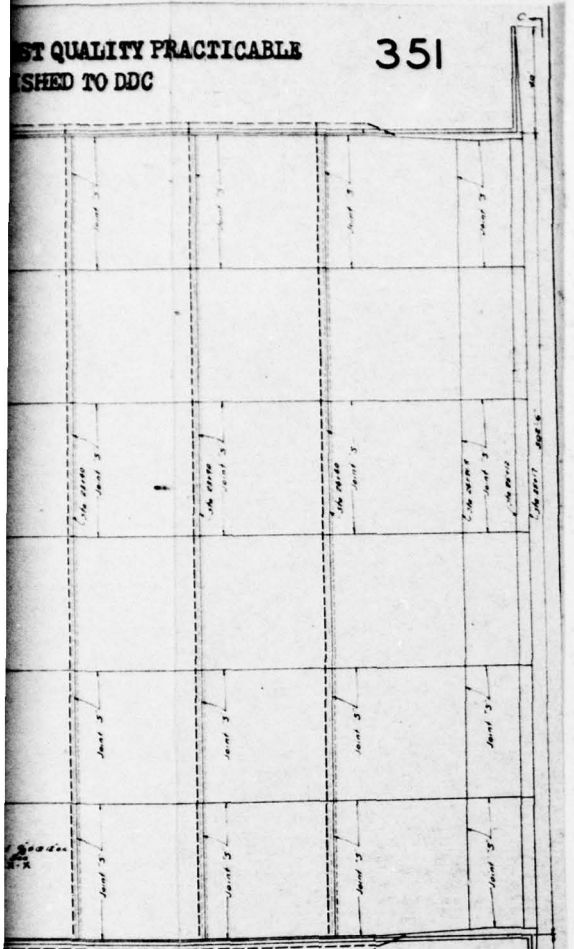
EFORE REMOVING THE TIMBER FLUME.
THE SAME TIME, OR WORK CAN BE

CRETE.

PLATE X

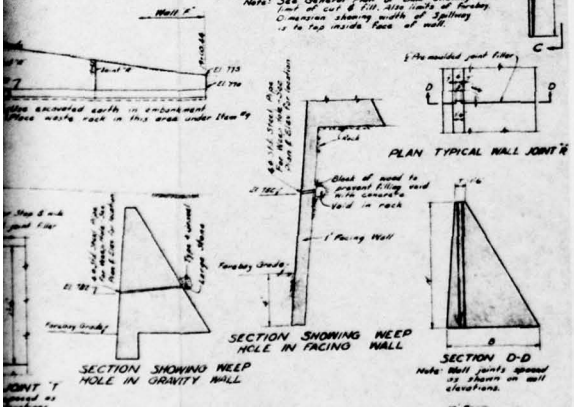
VISED	THE GENERAL STATE AUTHORITY	PROJECT NO. - GSA - 101-2
	APPROVED	REPAIRS AND IMPROVEMENTS TO LITTLE PINE CREEK DAM
	APPROVED	SUGGESTED PROCEDURE
	SUBMITTED	GARNETT FLEMING CORDRY & CARPENTER INC. 600 N. 2nd ST. HARRISBURG, PENNA.
	APPROVED	1949 PROGRAM DATE NOV. 1948 SCALE AS SHOWN
	APPROVED	THE GENERAL STATE AUTHORITY HARRISBURG, PENNSYLVANIA
	ACCEPTED	SHEET NO. 4
	ACCEPTED	CHECKED FOR G. S. A.
	ACCEPTED	





PLAN of SPILLWAY
FLOOR SLABS, JOINTS, CUT OFF WALLS & UNDERDRAINS
Scale 1"=20'

Note: See General Plan of Dam showing limit of cut & fill. Also limits of Forebay. Dimension showing width of Spillway is to top inside face of wall.

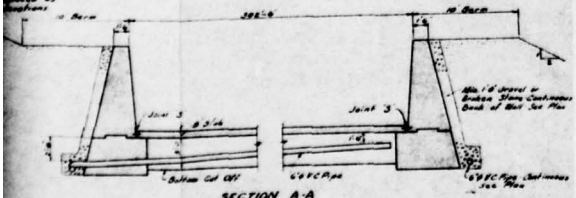


SECTION SHOWING WEEP HOLE IN GRAVITY WALL

SECTION SHOWING WEEP HOLE IN FACING WALL

PLAN TYPICAL WALL JOINT 'R'

SECTION D-D
Note: Wall joints spaced as shown on wall elevations.



SECTION A-A

PLATE XI

SUBMITTED J. D. Carpenter GANNETT FLEMING CORDRY & CARPENTER, INC. CONSULTING ENGINEERS	LITTLE PINE CREEK DAM	
APPROVED CHIEF ENGR. DEPT OF FORESTS & WATERS	SPILLWAY DETAILS SCALES - AS SHOWN	
APPROVED SECRETARY, DEPT OF FORESTS & WATERS		
APPROVED GOVERNOR	DATE 11-12-48	COMMONWEALTH OF PENNA DEPT OF FORESTS & WATERS HARRISBURG, PA
ACCEPTED CONTRACTOR		SHEET NO 4